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Animal Tracks Wetlands Action Pack

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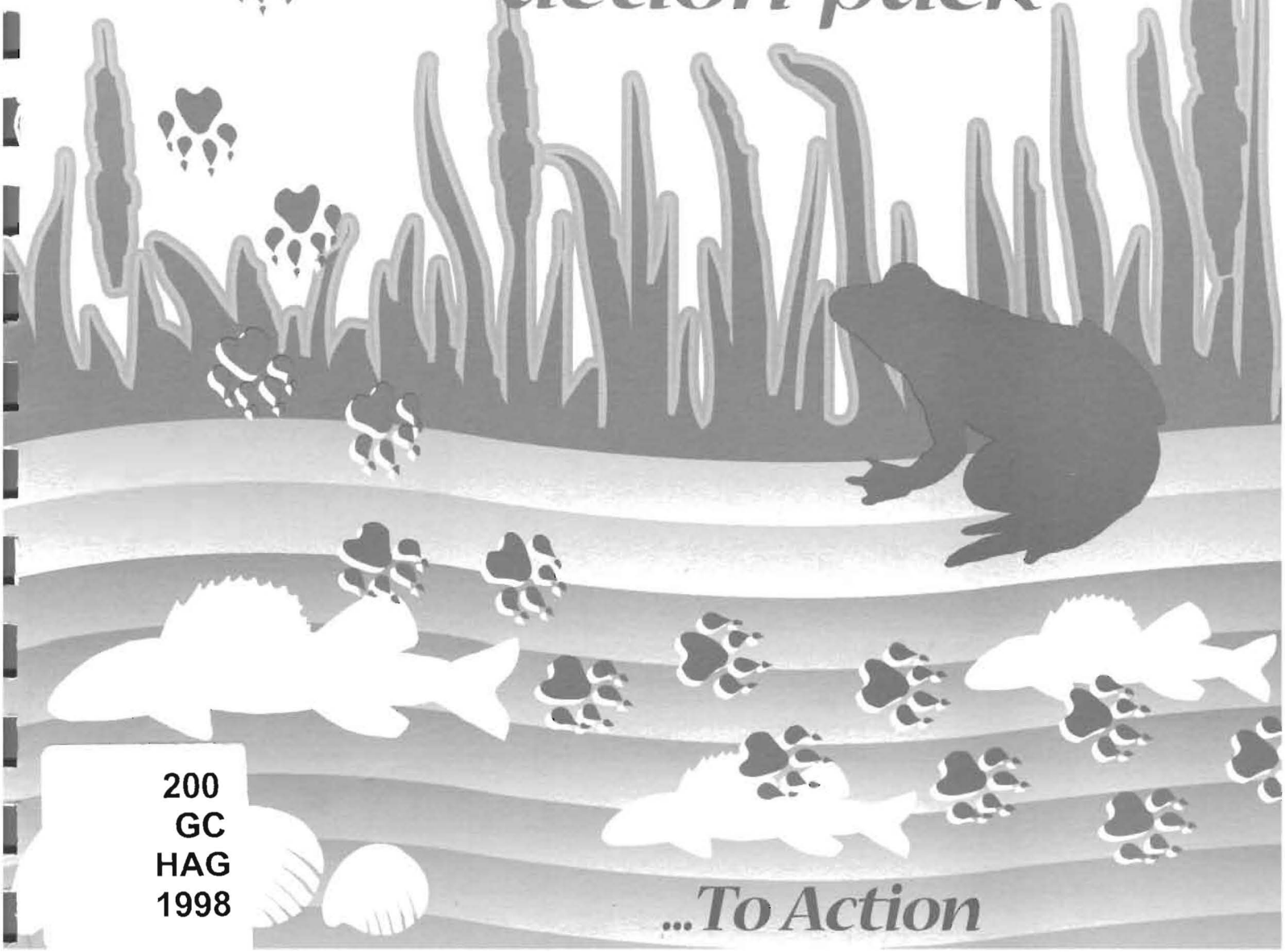
Follow the Tracks...

Animal Tracks®

Wetlands

action pack



...To Action

Animal Tracks®

WETLANDS

Action Pack

January 26, 1998

NSLC
c/o ETR Associates
4 Carbonero Way
Scotts Valley, CA 95066

Animal Tracks® Wetlands Action Pack
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Spanish translation by Education Consulting Services

The **National Wildlife Federation** (NWF) unites people of all walks of life to conserve our land, water, and wildlife in our own communities and around the world. Since our beginning in 1936, NWF has believed that educating people about conservation is the best way to encourage them to practice it. We act on this belief with programs that make conservation understandable and accessible to all.

NWF Regional Resource Centers:
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Southeast Natural Resource Center - Atlanta, GA (404) 876-8733
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For more information about NWF, NWF's Resource Centers, state affiliates, and other education programs check out our web site at **http://www.nwf.org**, call (703) 790-4100 or write: National Wildlife Federation, 8925 Leesburg Pike, Vienna, VA 22184

Other Animal Tracks Action Pack Titles:
Habitat
Northern Forest
Urban
Water

NATIONAL WILDLIFE FEDERATION®

Dear Educator:

Welcome to **Animal Tracks®**, a classroom education program of the National Wildlife Federation focusing on teacher training and environmental education resources. In Animal Tracks materials, the animals and their tracks lead educators and students on an exploration of conservation issues.

Thank you for using this Action Pack, our newest resource. We hope you find the Action Packs useful and as a "work-in-progress," we welcome any comments you might have for improvements. As you turn the page you'll see our questionnaire. Please take a minute to fill it out and put it in the mail. We'll include you on our mailing list and you'll get invitations to any Animal Tracks educator workshops that we hold in your area as well as the latest information on Animal Tracks programs and materials.

Animal Tracks Workshops are a large part of the Animal Tracks program. The Action Pack series was originally developed as our teacher training module. The workshops are designed to help teachers easily fit environmental and conservation issues into their lesson plans across the curriculum. Animal Tracks workshops emphasize learning by doing and include an interactive discussion of how to successfully incorporate action projects into learning.

Animal Tracks has educator materials and information available **online** at **http://www.nwf.org/atracks** including the Water and Habitat Action Packs, Current Events Hotline, information about NWF's EarthTomorrow® program for Detroit area schools, Environmental Education Online Conference, Animal Tracks Workshop schedule, and Animal Tracks Online classroom activities. There are also Animal Tracks kids' pages at **http://www.nwf.org/nwf/kids/** with our ***Cool Tour of the Environment***, Ranger Rick® site, resources in *Spanish*, games, and more fun.

The next pages of the Action Pack are a questionnaire and an explanation about how to effectively use the Animal Tracks Action Packs. Again, we hope you find this a valuable resource and be sure to check out all the Animal Tracks Action Pack titles!

Sincerely,
The Animal Tracks Staff

Welcome to the Animal Tracks Action Pack!!!

Each action pack is specifically designed to be an introductory unit for educators that work with students in grades K-8. The Animal Tracks theme of *Follow the Tracks to Action* is reflected in each Action Pack as the section works together to compliment the learning process. Students are taken from *Discovery* of the topic to *Awareness* of the issues related to the topic and then encouraged to take individual *Action* to positively impact the environment. To maximize comprehension of the topic, we recommend using the Action Pack as a unit, but activities can also be used separately to enhance other units.

Following is a description of each section of the Action Pack and suggestions for using the sections together as a unit.

Discovery section - provides a *quick look* at the background information surrounding the topic. It also contains *fun facts* to engage the interest of your students. The learning objectives contained in the discovery section help you include the activities of the Action Pack into the curriculum.

Awareness section - contains several indoor and outdoor activities for students in grades K-8 which can be used consecutively in a unit or individually to enhance other units. These activities illustrate key environmental concepts through fun-filled and challenging cross-curricular lessons. A ready-to-copy Kids' Page is included for individual student work. As a special bonus all student pages, including the Kids' Page, are translated into Spanish for content accessible to ESL students or foreign language classes.

Action section - uses step by step guidelines for environmental action and service learning projects to help students go the next step in understanding complex issues. This section contains worksheets for students to plan their action projects. A case study features an action project implemented by students to heighten community awareness of their environment. Also included, are a number of ideas for projects to help get groups started.

Appendices section - provides educators with quick references and resources to help in the planning of the unit. These appendices include a glossary, guide to additional activities, resources for teachers and children, related organizations and web sites, opportunities for getting recognized, and information on other NWF education programs.

Special Features:

- Special activities just for early elementary (K-2) students
- Kids' Pages with "self guided" activities and information for students
- Assessment activities with extensions/modifications ideas
- Student pages in English and Spanish
- Resources for further reading for teachers and students
- Additional related activities from other NWF resources referenced by grade level

Let us hear from you!

The Animal Tracks staff is committed to serving you and other educators. Write, call, or e-mail us your thoughts and comments on how you used the Action Pack and what you would like to see in its next revision. Refer to the following "Send Your Comments" questionnaire.

Animal Tracks Questionnaire

Name: _____

Address: _____

Email: _____ Phone: _____ Fax: _____

I am a(n): ❒ Teacher ❒ Parent ❒ Home Schooler ❒ Other
Grade(s): _____ Subject Specialty _____

How did you find out about Animal Tracks Action Packs?
❒ Animal Tracks Brochure ❒ NWF's Website ❒ Workshop ❒ Conference ❒ Other _____

Please make any comments on the different sections of the Action Pack below.

Discovery:

_____

_____

_____

Awareness:

_____

_____

_____

Action:

_____

_____

_____

Appendices:

_____

_____

_____

Suggested Topics for future Animal Tracks Action Packs:

_____

Place
Stamp
Here

Animal Tracks
National Wildlife Federation
8925 Leesburg Pike
Vienna, VA 22184

Thank You for Your Thoughts and Comments!

CONTENTS

Discovery Notes...

DISCOVERY

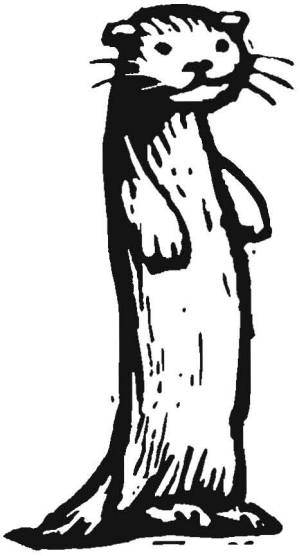
"Civilization began around wetlands; today's civilization has every reason to leave them wet and wild."

-Edward Maltby,
Waterlogged Wealth

Fun Facts

Mangrove swamps absorb much of the shock of tidal waves caused by hurricanes; this protects populated in-land areas.

Foxes and other egg thieves cannot walk on marshy ground, so to keep their young safe, reed warblers build their nests in tall marsh reeds.



Fish usually lay eggs, but the female archerfish gives birth to live young.

It takes 453,600 grams of water to grow 1,134 grams of wheat.

❖❖❖

It takes 4,536,000 grams of water to grow 1,134 grams of rice.

❖❖❖

It takes 9,979,200 grams of water to grow 1,134 grams of cotton.

A Quick Look

Wetlands offer an abundance of benefits to humans and wildlife. Along with giving shelter and sustenance to a large variety of plants and animals, wetlands help control floods, improve water quality, provide numerous jobs, and add billions of dollars to our national economy each year.

You would think that people would make it a priority to protect this important habitat, but protection measures have only been recent. Between 1780 and 1995, the US lost 122 million acres of natural wetlands. Despite legislation, which has slowed the loss, a significant amount of wetlands are destroyed each year.

This Action Pack will answer the following *wetlands* questions:

✔ What is a wetland?
✔ What are some types of wetlands?
✔ Why are wetlands beneficial?
✔ Why are we losing so much wetland habitat?
✔ What would the world be like without wetlands?
✔ What are some ways your students can help preserve our wetlands?

Background

It is difficult to absolutely define a wetland because there are many different types of wetlands. Fresh and salt water marshes, swamps, and bogs are just a few of the habitats referred to as wetlands. All are *wet*, but unlike ponds, rivers, streams, and lakes, wetlands are covered in a shallow layer of muddy water, for at least part of the year, and sustain a variety of both plant and animal life. Rain, groundwater, lake and river run-off, ocean tides, and other outside sources help keep wetlands wet.

Some wetlands have unique origins. Beavers are wetland architects; sometimes their dams re-route lakes and streams, turning meadows into marshes and forests into swamps. Humans also create wetlands, intentionally and unintentionally. An area might be intentionally flooded and vegetation planted so that ducks and other water fowl will have place to breed. Building or road construction may block a natural water way, which causes an overflow, and a swamp or marsh to be born. Seasonal conditions may create temporary wetlands and support wildlife which have adapted to this local phenomenon.

The Benefits of Wetlands

Wetlands provide services many people take for granted. Wetlands help control storm waters and floods because they act like shields and "super sponges." Raging waters lose force as they are absorbed and dispersed across a wetland. Wetlands also help protect our water supply from pollutants and other impurities; they trap silt and other sediments that might otherwise pollute streams, rivers, lakes, and oceans. Silt can also clog aquatic animals' gills and bury their eggs. In addition to being a barrier and a filter, wetland plants bind soil and help to minimize erosion. Mangrove swamps are particularly good at this. In fact, certain islands cleared of their mangrove swamps have become so severely eroded that they are in danger of being completely washed away.

Wetlands are the perfect nursery for many birds, fish, crabs, and other new born animals. The dense vegetation provides shelter and protection, and an abundant amount of food helps baby wetland animals

grow up healthy, increasing their chances of survival. Many fish and other animals that form the base of the food chains in oceans, lakes, and rivers get their start in wetland nurseries. Almost all animal life in the world's oceans depend on abundant and healthy wetlands for their existence.

A healthy wetland can support an enormous amount of plant and animal life. Wetlands are popular sites for migrant birds. Each year, thousands of ducks, geese, herons, egrets, sandpipers, plovers, eagles, and ospreys converge on wetlands en route to their winter or summer homes. Here they replenish their energy on the nutritious food supply before continuing on to final destinations.

Perhaps most importantly, wetlands provide refuge for an increasing number of endangered animals. Approximately one-third of all plants and animals listed as threatened or endangered in the United States live in or depend on wetlands in some way. That's a very critical statistic when you consider that only about 5% of the mainland US is made up of wetlands, and that acreage decreases annually.

Wetlands Habitat Loss

Lack of knowledge, urban sprawl, and farming are just some of the reasons North America lost 50% of its wetlands since the arrival of the first European settlers. Many people thought of wetlands as *wastelands*, places where the water stank and harbored insects. Unaware that insects are an important food source for many animals, the wetlands were filled and the "pests" eliminated. Wetland are often adjacent to larger bodies of water, which people like to live near. As the human population grows, wetlands are filled in to develop shopping malls, office buildings, and farms. Filled wetlands quickly become prime real estate for developers. There is hope; people are working to save and increase wetlands, which you will learn about later in the Action Pack.

So Many Types of Wetlands

There are many different types of wetlands. Fresh and saltwater marshes, swamps, bogs, estuaries, and sloughs are just a few. Wetlands can be found just about everywhere in the world, including the Arctic. This Action Pack will cover the most common wetlands, and hopefully peak your interest on the wonders of all of our wetland habitats. The resource section can help you start this journey.

Freshwater Marshes

The world's freshwater wetlands provide a very special environment for aquatic plants and animals, much different from those of the ocean. Freshwater marshes are full of life. Scientists consider some to be the most productive habitats on earth, since they provide food, shelter, and water to such a large variety of birds, fish, insects, mammals, and reptiles. Freshwater marshes are distinguished by the type of vegetation that grows there. Thick sections of soft-stemmed plants such as grasses, sedges, and rushes are usually abundant, as are cattails, water lilies, smartweeds, arrowheads, and other non-woody marsh plants. Three of the most common freshwater marshes are deep marshes, shallow marshes, and wet meadows.

Deep Marshes are usually found near lakes, ponds, and rivers, but can also form in deep *potholes*. Most are fed by rain and snow run-off and usually flood every year. During wet periods these marshes can be up to four feet deep and there are often areas of open water. Cattails, bulrushes, water lilies, and duckweed are common deep marsh plants.

Shallow Marshes are often found next to deep marshes. They are not flooded as often and, as a result, the water level remains around six to twelve inches. Grasses, sedges, cattails, and bur reeds are common shallow marsh plants.

Wet Meadows flood every year and their soil is always saturated with water, although never very deep. Wet meadows form in poorly drained, low-lying areas along streams and rivers. Sedges, grasses, rushes, and wildflowers thrive in these areas.

Saltwater Marsh

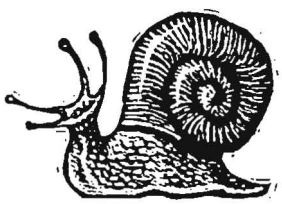
Saltwater wetlands stretch along most of the world's coastlines and support very important communities of plants and animals that flourish between open water and dry land. Saltwater marshes can usually be found along the inner reaches of coves, inlets, estuaries, and bays, since they are protected from the crashing surf. Tough grasses, called spartinas, are the most common saltwater marsh plant. Silt and sediments brought in on the tides help marsh plants to thrive. Spartina provides shelter and nutrients for salt marsh animals, such as the marsh snail. Decomposing vegetation and animals are known collectively as detritus. Salt marsh algae grow on detritus, which then feeds birds, crabs, fish, mussels, clams, and many other animals. Because of this abundant food, many migrating birds use salt marshes as nesting, resting and refueling stations. Few larger animals make salt marshes their permanent home, although animals such as raccoons, foxes, and minks use the salt marshes as hunting grounds.

What Makes a Swamp a Swamp?

Swamps are defined as wetlands that are dominated by shrubs and trees. Not many types of trees can grow in such waterlogged conditions; some swamp trees have roots that stick out of the water and take in air. Cypress and mangrove are two very special types of trees that can flourish in a swamp environment. Many other interesting plants and animals make their home in swamps, including the water hyacinth, water lettuce, fiddler crab, mudskipper fish, snapping turtle, archer fish, and purple gallinule. Most freshwater swamps fall into these two general groups:

Forested Swamps are often associated with major river systems, such as the Mississippi. They stay wet most of the year and are subject to periodic flooding. Forested swamps are famous for their huge bald cypress, overcup oak, and tupelo trees.

Shrub Swamps in North America are characterized by scrubby, low growing vegetation, which form on the edges of lakes, forested swamps, marshes, and streams. Some of these shallow swamps are wet for only part of the year. There are different types of shrub swamps. Boreal swamps found in the north are called *heaths* and shrubby southeastern coastal swamps are referred to as *pocosins*.



What Makes a Bog a Bog?

Bogs are found in high latitude regions of the world where there is a lot of precipitation and low evaporation. Bog moss, or sphagnum, invades the wetland and acts as a sponge. Bog moss can hold ten times its weight in water; it attracts nutrients to its surface and holds them so they are no longer available to other plants. This makes the wetland water very acidic and poor in nutrients. Eventually, only acid tolerant plants such as cranberries, sundews, and cotton sedges survive, and a bog is born. Over time, the bog moss accumulates and peat forms. *Peat* is an excellent energy source and soil conditioner, which is the reason almost all of Ireland's ancient bogs have been excavated and destroyed. Many wading birds bred in bogs, including golden plovers, cranes, greenshanks, and curlews. Moose, deer, bears, and other large animals visit bogs at certain times of the year to find food, shelter, and water.

A World Without Wetlands

A world without wetlands would be a world without egrets, alligators, herons, ducks, muddskippers, mangroves, cypress, most sea creatures, and so much more. In nature, balance plays a very crucial role. Every plant and animal depends in some way on another for survival. If wetlands were to disappear, there is no telling what long term effects it would have on the rest of the world's habitats.

AWARENESS

"Let nature be your teacher."

-William Wordsworth

Awareness Notes...

Puddle Wonders!

SUMMARY: Students will observe water that accumulates in puddles on or near the school grounds as well as any associated wildlife. Older students also measure the depth, area, and volume of the puddle.

GRADE LEVEL: 2-12

TIME: two or three 20-45 minute sessions

SUBJECTS: Science, Math

MATERIALS:
- pencils
- paper
- measuring instruments (rulers, yardsticks, tape measures);
- string (for use in making measurements)

For Younger Students: no materials needed

LEARNING OBJECTIVES: Completing this activity will allow students to:
- ✔ predict where puddles will form and how they will change
- ✔ observe and describe organisms that live in or near puddles
- ✔ measure and record the amount of water in puddles
- ✔ make inferences about what types of organisms occupy puddles

NOTE: This activity should be conducted at a time of year when rainfall is likely, if possible. Ideally, students investigate school grounds before and after a rainstorm. In arid areas, puddles may be created with buckets or water hoses.

BACKGROUND:
Water flows downhill and for a variety of reasons it sometimes stops flowing. When this happens a puddle, pond, lake, or inland sea is formed. Puddles form in low spots or depressions in the land's surface. Water gathers in depressions until the holding basin is filled to capacity. Then the water flows out on the downhill side. Depending on the size of the puddle, water may be trapped for some time. If the puddle lasts for several days, there is a strong possibility it will be visited by wildlife.

As an example, one of the most amazing life histories is that of the spadefoot toad. Spadefoots spend most of their adult life underground. They emerge at night to feed on insects and other invertebrates during warm weather. In extreme cold or hot weather these toads stay hidden. Immediately after the first heavy rains of summer, spadefoots emerge to mate. The female lays between 300 and 500 eggs in temporary puddles and ponds. The male goes into the puddle or pond and externally fertilizes the eggs. The eggs hatch and the tadpoles complete their development in 10 to 12 days-hopefully completing their growth before the water dries up!

Many other toads and salamanders also use temporary puddles and ponds for their reproduction. What advantage could a temporary pond have over a permanent pond? One favored theory is that temporary

ponds have no fish to prey on the eggs or tadpoles. Freshwater shrimp such as fairy shrimp and tadpole shrimp also utilize temporary puddles and ponds to reproduce. One-celled animals, aquatic insects and other invertebrates also use puddles for reproduction. Many species of flying insects such as butterflies, wasps and flies visit puddles and appear to "suck" from the mud at the puddle's edge. They are getting vital salts and other minerals from the mud.

Some animals may visit puddles for mud-building materials for nests. For example, some species of swallows and mud-dauber wasps do this. Other animals may visit the puddle to bathe or drink. Many animals take advantage of temporary puddles and ponds to reproduce, thus completing the animals' life cycle.

Studying ponds and lakes and the life forms found in and around them is a primary concern to many aquatic biologists. Some of the techniques these biologists use can also be duplicated by students examining schoolyard puddles. Size, depth, circumference, cause of accumulation and the identity of transient animal life can be determined by simple observations and measurements.

The major purpose of this activity is to increase the students' appreciation of the value of something as apparently humble as a schoolyard puddle!

PROCEDURE:

1. Begin with a discussion about rainfall and runoff. Where does the water come from? Where does the water go? When water ceases to run off a surface, a puddle forms. Tell the students that the class will make a study of the smallest body formed as water flows across the land —the puddle! If necessary in drier climates, a few puddles could be created by using buckets or a hose.

2. Divide the students into teams of three to five members. Send the teams outside on the school grounds to make observations and predictions about where puddles will form in a rain storm. Have each team of students prepare a map of the school, showing the location of the predicted puddles. Also have the students make a comprehensive list of all the forms of wildlife that can be seen on the school site. Look for birds, insects, rodents, worms, mammals, reptiles, etc. Ask the students to look beyond direct observation and also find indirect evidence of wildlife, like tracks, droppings (scat), slug trails, feathers, ant hills, etc. Keep these maps and wildlife lists for later use following the storm.

3. After a storm, when there are puddles on the school grounds, send the teams outside again. They should again map the school grounds, this time locating the actual position and gross dimensions of the puddles on their maps. They should find the area of one or more puddles.

$$\text{Area} = \text{Length(average)} \times \text{Width(average)}$$

$$\text{Average Length (La)} = \frac{L1 + L2 + L3}{3}$$

$$\text{Average Width (Wa)} = \frac{W1 + W2 + W3}{3}$$

The team should also determine the volume of water in one or more puddles. Before that number can be calculated, the average depth of the puddle must be measured. Use the following formula for average depth (Da).

$$\text{Average Depth} = \frac{D1 + D2 + D3 + D4 + D5 + D6 + D7 + D8 + D9 + D10}{10 \text{ (number of measurements)}}$$

4. Once all the measurements have been taken for each puddle - or during the same period of time while at a puddle - the team should also make observations about wildlife. Each team should list any species of animal for which they have direct or indirect evidence of using the puddle in some way. Ask them to organize their observations in a written form. For example, they could list species, evidence, apparent uses of puddle by species, estimate number of animals of this kind using the puddle.

5. Back in the classroom ask each team to report. Discuss their findings. Compare similarities and differences in the teams' findings. Ask the teams to compare their early predictions about the puddles and wildlife with their actual findings. After all the reports are finished, ask each team to make a summary statement of one minute or less reflecting the inherently fascinating nature of the under-appreciate puddle.

PROCEDURE FOR YOUNGER STUDENTS:

1. Begin with a discussion about rainfall and runoff. Where does the water come from? Where does the water go? When water ceases to run off a surface, a puddle forms. Tell the students that the class will make a study of the smallest body formed as water flows across the land—the puddle! If necessary in drier climates, a few puddles could be created by using buckets or a hose.

2. Divide the students into small groups of three to five. Before a storm, take them to different areas of the school grounds. Have them try to guess where they think puddles will form. Have them guess what wildlife might use the puddles when the rains come. For what purposes? If the school ground is paved, have them draw chalk outlines to show where they think the puddles will be.

3. After the next rainy period, take them outside to take an inventory of puddles on the school grounds. Were they right? Did puddles form where they had guessed they would? If the puddle areas overflowed, have them trace where the "extra" water went. If they made diagrams before, they can add pictures of where the puddles actually formed and compare.

4. Next, look for any signs of wildlife in or near the puddles. Make a simple list of kinds of wildlife and tally the numbers of each, or evidence of each, that the students observe. If possible, have each small group of students make their own list.

5. Back in the classroom ask the students what they have learned about puddles. Are they important? If yes, what is important about puddles? If no, explain why. Talk about puddles and wildlife as part of the discussion. After the students have offered some of their observations in informal discussion, ask each student or small group of students to name one word or idea about puddles. List all the words on a chalkboard for everyone to see.

MODIFICATIONS AND ADAPTATIONS:

- ❖ Find relatively permanent puddles (small ponds) and carry out the same observations as those done with the playground puddles.

- ❖ Have the students draw diagrams on paper to show where they think the puddles will be.

- ❖ Ask the students to write a poem using some or all of the words; arrange the words in the shape of a puddle; or draw a picture about puddles and wildlife, including some or all of the words.

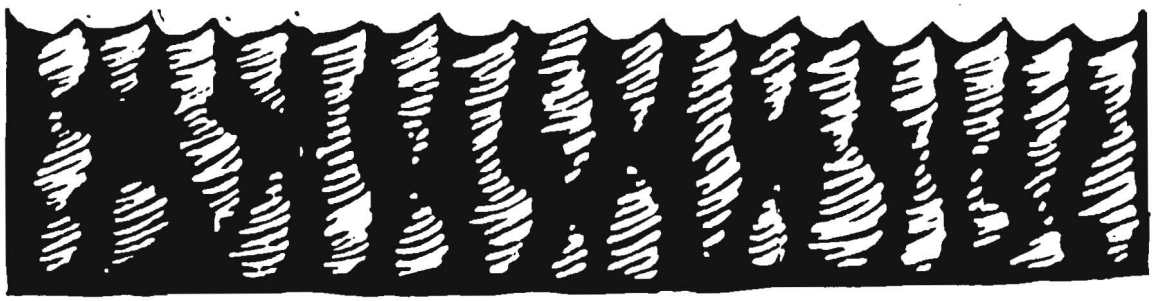
- ❖ If a puddle is on blacktop, you can sprinkle a fine dust of cooking flour round the puddle so that tracks can be seen. Put the flour in a salt shaker to sprinkle it. Record the time of day when the flour is sprinkled. During the day-recess, etc.-encourage the students to notice if there are any changes. Are there bird tracks? Signs of insects? Tracks of mammals? You and the students can also keep a record of how long the puddles last. One day? Two days? A week? Longer? Which puddle is the first to disappear? Why? Which puddle is the last to disappear? Why?

EXTENSIONS AND ASSESSMENTS: (✱✱ extensions can also be used to assess the students' mastery of the learning objectives.)

- ❖ Keep a record of these areas of accumulation over the seasons. What similarities occur? What differences? Ask the students to calculate how much water is "caught" each year by the puddles they studied.

- ❖❖ Have students create a bulletin board display on puddle wildlife on the school grounds. Include a listing of all the wildlife observed in or around the puddles, with illustrations and a description of where the wildlife was seen.

- ❖❖ Have a puddle predicting contest linked to the daily weather forecast. Each day read the weather forecast and when it calls for rain, have a team of students predict where the puddles will form on the school grounds. Keep a map with the students' predictions and the results.



Wetland Habitats

SUMMARY: Uses a flow chart to introduce and sort out the common types of wetlands.

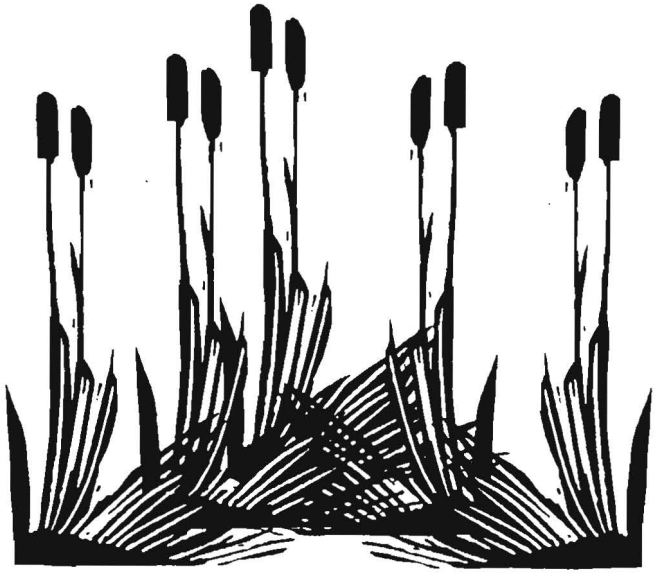
GRADE LEVEL: 6-12

TIME: 45 minutes

SUBJECTS: Ecology, Life Science

MATERIALS:
- pictures of wetlands (magazines, books, posters)
- paper and pencils

Optional: Map of the United States



HANDOUTS:

➤ *Wetlands Habitats Flow Chart* (p. 16)
➤ *Habitat Cards* (pp. 17-19)

LEARNING OBJECTIVES: Completing this activity will allow students to:
✔ classify wetlands based on their characteristics

BACKGROUND:
A habitat is the place where an animal finds food, water, shelter, and places to raise young in a particular arrangement. Wetlands offer a wide variety of habitat types for many species of wildlife.

An area does not always have to be wet to be considered a wetland. Many wetlands are covered by water only during the rainy spring season. Others are regularly or infrequently flooded by tides, while others may be covered by water most or all of the time.

Some wetlands have salty water, while others are wetted by freshwater streams, rivers, ponds or lakes, or rainwater. Differences in salinity and wetness, as well as slope, elevation, and climate, cause differing plant communities to develop. Wetlands are classified, in part, by the type of water, frequency and degree of inundation, and types of vegetation most prevalent there.

PROCEDURE:

1. Discuss the preceding, using pictures of wetlands as examples. Define habitat. Explain that students will be using a flow chart to identify ten wetland types by the habitats they provide. Review the use of a flow chart and practice as a group with one of the pictures.

2. Have students, working individually, in pairs, or in threes, use the *Wetland Habitats Flow Chart* to identify the ten wetlands described on the *Habitat Cards*. Advanced students may be able to identify photographs using the flow chart. They will have to infer the salinity by the types of plants shown.

Answers: 1. sandy beach, 2. shrub swamp, 3. aquatic plant bed, 4. wet meadow, 5. mud flat, 6. tidal freshwater marsh, 7. forested wetland, 8. seagrass bed, 9. bog, 10. salt marsh

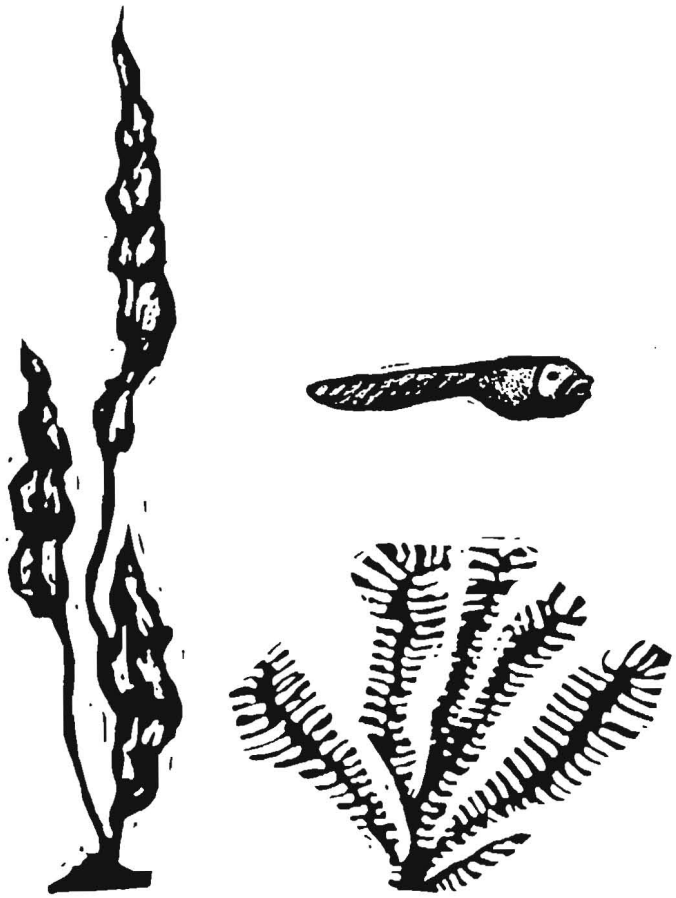
3. Ask students to name different types of wetlands. What kinds of plants grow there? Is the water salty or fresh? Do students think they could classify a real wetland on a visit? Have them try!

EXTENSIONS AND ASSESSMENTS: (✵✵ extensions can also be used to assess the students' mastery of the learning objectives.)

- ❖❖ Have students create a video or multimedia guide to wetland habitats. Have students work in teams to write a description of each wetland type, make a map of where these wetlands are located, draw pictures or take photographs or videos of the wetlands, and list wildlife that can be found in each habitat.

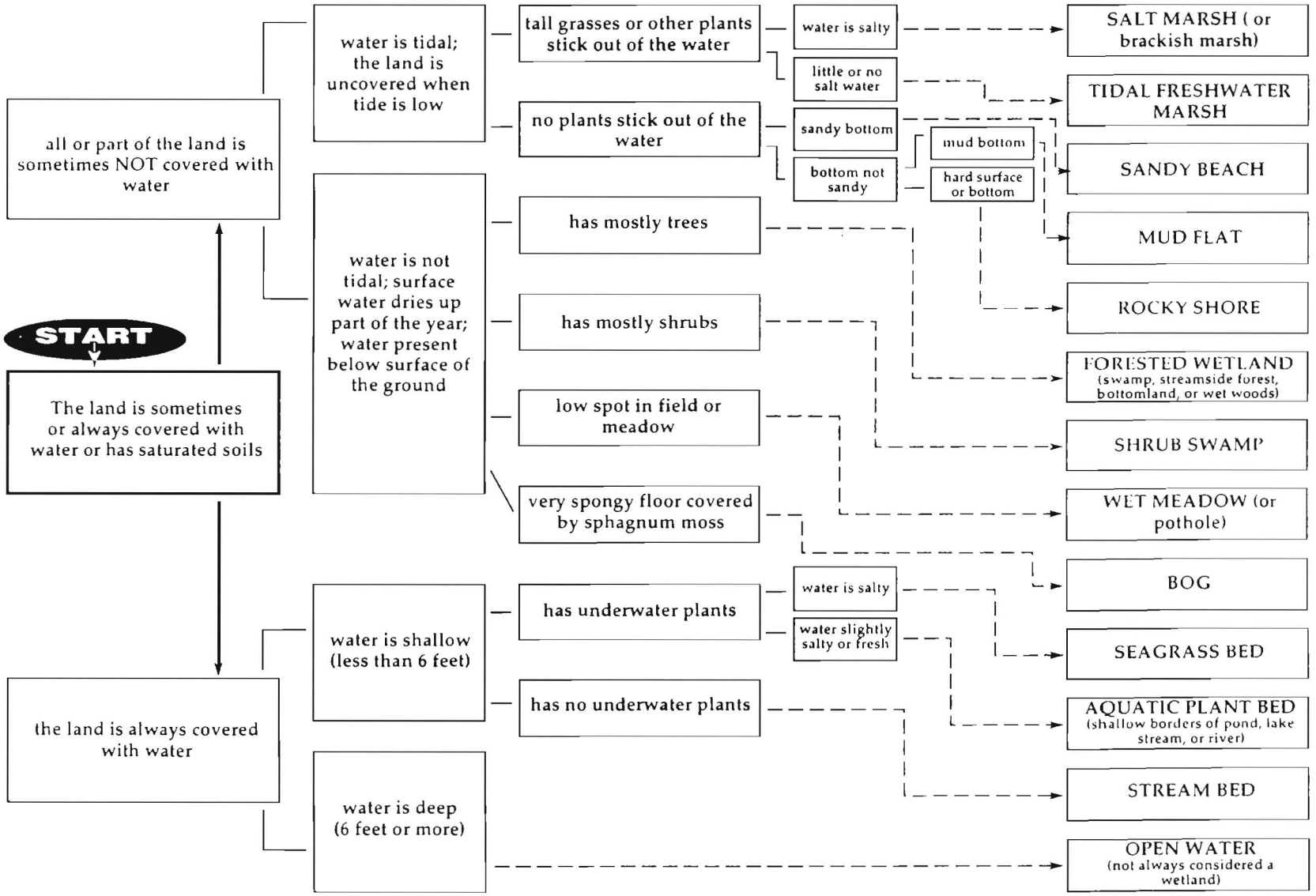
- ❖❖ Have students write a creative story about life in a wetland habitat from the viewpoint of an animal or plant that lives in that habitat. The stories should include a description of the water and plants in the habitat.

Adapted from "Classifying Habitats of the Chesapeake Bay" in The Changing Chesapeake *pp. 19-22, National Aquarium in Baltimore.*



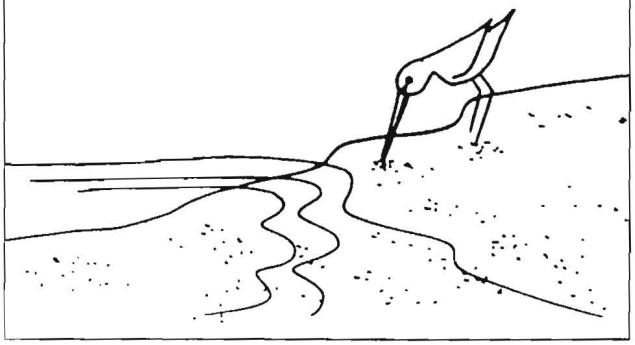
Wetland Habitats Flow Chart

Carefully read each of the habitat cards, then use this flow chart to identify each habitat. Start at the left side of the page at the first box. There are two boxes connected to that box—choose the one that matches the description on the card. Then move on to the next set of boxes, following the lines, and make another choice. Continue until you reach the name of the habitat described on the card. Can you identify all ten habitats?



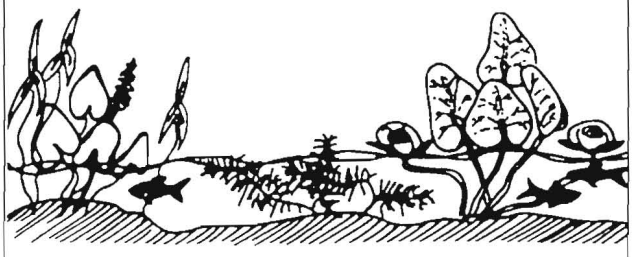
Habitat Cards

1. During storms, the waves push grains of sand into ever-changing patterns. During low tide the animals that live among the sand grains feel the summer heat or the winter cold. Shore birds search along the water's edge for these animals and for bits of food that wash in from the water. No plants grow here.

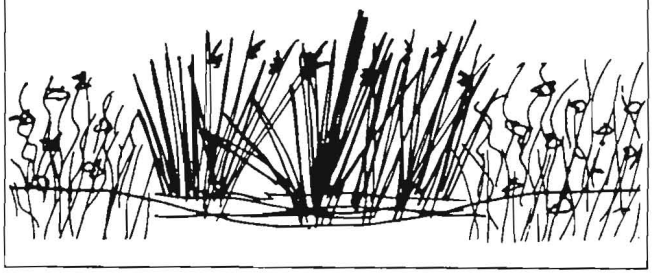


2. Scrubby, low-growing thickets of shrubs grow here, in places that may have started out as wet meadows. You might find these places near the coast, or where lakes, streams, rivers, marshes, and forested swamps overflow. They are not always covered with water. This type of wetland offers good habitat for fish, reptiles, amphibians, and many other animals.

3. In the shallow borders of ponds, lakes, rivers, and streams, where there is good light and the water has little salt, underwater plants and plants with floating leaves grow. Some of these plants are valuable food for many kinds of waterfowl including ducks, geese, and swans. All make places for little fish and other animals to live and feed. These plants slow water movement and protect the soil on shores and banks from erosion.

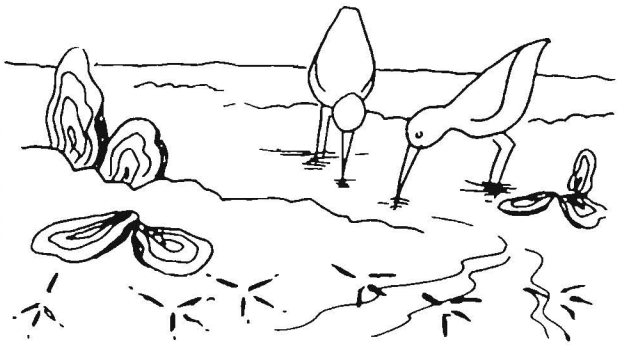


4. Depressions in the ground may fill with rain and ground water and stay wet for several days or weeks. Landowners often mow or plow around these spots to avoid getting tractor wheels stuck in the soft ground. On spring evenings, these puddles seem alive with the high-pitched calls of spring peepers (tiny frogs) looking for mates among the rushes and sedges that grow here. In the heat of the summer, these places usually dry up.

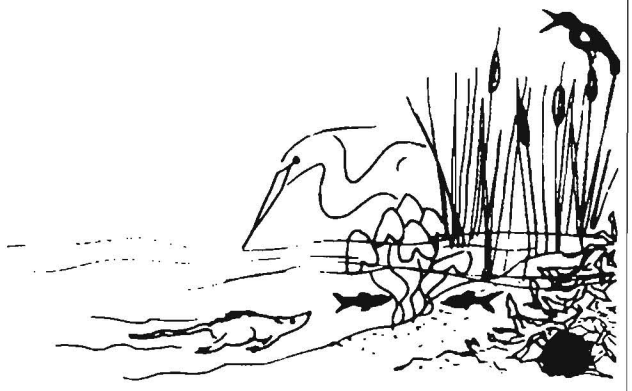


Habitat Cards

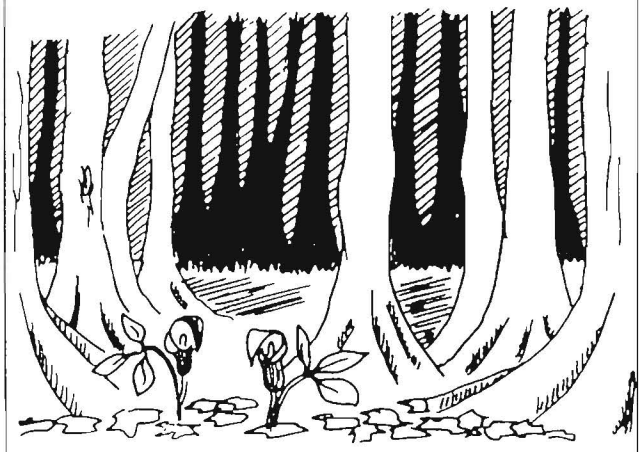
5. Fine particles of dirt make mud when they settle out of the water. Where the water is very shallow, the muddy bottom is uncovered at low tide. While this area may not look like home to many animals, and few or no plants grow here, lots of creatures live down in the mud. Watch for hungry shore birds searching for them in the mud.



6. Tall grasses and other kinds of plants grow up out of the water. The water contains little or no salt, but the push of incoming tides is strong enough to raise the water level in the river. The ground is sometimes flooded and sometimes dry or exposed. The plants provide food and places to hide for many kinds of animals including fish, invertebrates, muskrats, and lots of birds.



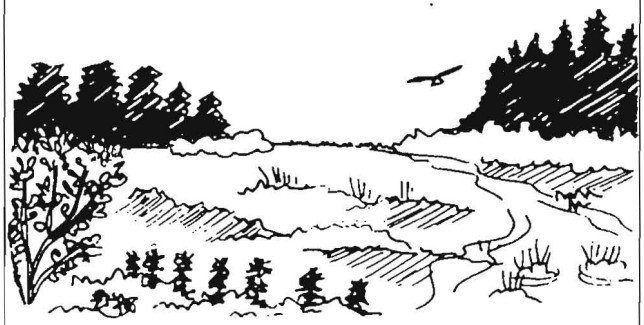
7. Where trees grow in low-lying areas, the ground may hold water for part of the year. In the spring, many beautiful wildflowers grow here, and frogs and salamanders find wet places to lay their eggs.



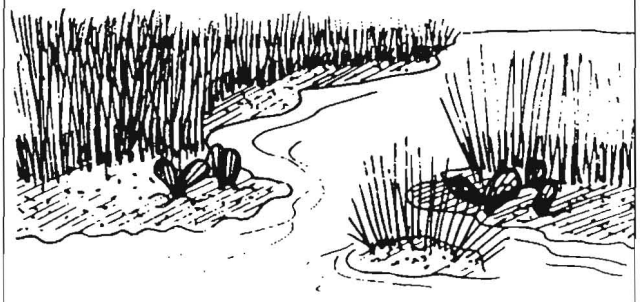
8. In salty bays or at the ocean's edge, two kinds of plants may grow under the shallow water. They can only live where it is shallow because they are rooted on the bottom and need light to make food. The plants are eaten by many animals, and many of them find safe places to live among the plants. These plants protect the shore and reduce the muddiness of the water by slowing the waves.

Habitat Cards

9. Old lakebeds and other low areas that fill with rainwater sometimes accumulate layers of partially decayed plants called peat. At first glance these places might look dry, but their moss-covered floors actually hold a good deal of fresh water just below the surface. The ground here feels very spongy. Some shrubs and evergreen trees also grow above the sphagnum moss. In these unusual conditions, many unique, beautiful, and rare plants and animals can be found.



10. Along the shore where the water is salty, tall grasses grow up out of the water. Tides move in and out, but some places are flooded only during storms and very high tides. When the tough plants here die, they break down in the water to form little particles called detritus. Many animals eat detritus by filtering it out of the water.



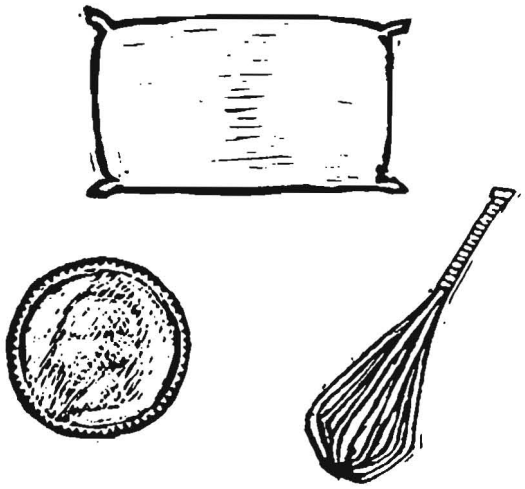
Wetland Metaphors

SUMMARY: Students are presented with a selection of "hands-on" objects for investigation as metaphors for natural functions of wetlands.

GRADE LEVEL: 1-12

TIME: One or two 30-60 minute sessions

SUBJECTS: Science, Language Arts



MATERIALS:
- large pillowcase, bag, or box
- sponge
- small pillow
- soap
- eggbeater, whisk, or mixer
- small doll cradle or basket
- sieve or strainer
- paper (coffee) filter
- antacid tablets
- small box of cereal
- 3x5 cards with pictures that could be used to show other wetland metaphors (a zoo could represent the idea of wildlife diversity in a wetland, a lush vegetable garden could represent the idea of a productive wetland in which food is abundant, a vacation resort could represent the idea of a resting or wintering place for migrating waterfowl)

NOTE: *A metaphoric approach such as this allows a variety of objects to suggest some appropriate linkage to the basic characteristics of wetlands.*

LEARNING OBJECTIVES: Completing this activity will allow students to:
- ✔ describe the characteristics of wetlands.
- ✔ demonstrate their understanding of the importance of wetlands to wildlife and humans.

BACKGROUND:
Wetlands are many different things to many different people. Some people have never heard or thought about wetlands. Others are working actively to protect wetlands because of their importance.

Wetlands include areas like freshwater and saltwater marshes, wet meadows, swamps, lagoons, bogs and prairie potholes. All wetlands, whether coastal or inland, provide special habitats that serve areas far beyond their boundaries. Wetlands are uniquely important to plants, animals, humans and the total environment.

Because of the abundance of food, vegetative cover (shelter), and water found there, most wetlands are rich with diverse wildlife species.

Coastal and inland marshes, for example, provide breeding, resting and wintering habitats for thousands of migratory birds —including ducks, geese, swans, cranes and shore birds. Many species of fish that are important for commercial and personal use by humans reproduce and spend part, or all, of their life cycle in fertile wetlands adjacent to larger, more open bodies of water. These fish species include bass, salmon, walleye, perch and pickerel. A wide variety of reptiles, amphibians, insects and crustaceans also breed and live in wetlands. Frogs and toads, turtles of all kinds, salamanders, snakes, dragonflies, water striders, clams and crayfish flourish in wetland habitats. Many mammals—from muskrats and beaver to whitetail deer and moose—also depend on wetland areas. Wetlands are often referred to as "nurseries" because they provide critical breeding and rearing habitats for countless numbers and kinds of wildlife.

Wetlands also have the unique ability to purify the environment. They act as natural filtering systems and have been shown to be extremely effective; for example, they can trap and neutralize sewage waste, allow silt to settle, and promote the decomposition of many toxic substances.

The importance of vegetation associated with wetlands cannot be overlooked. Plants absorb nutrients and help cycle them through food webs. Plants also help keep nutrient concentrations from reaching toxic levels. Plants slow down water flow causing silt to settle out. Through photosynthesis, plants add oxygen to the system and provide food to other life forms.

Of great importance to humans are the flood control characteristics of wetlands. When runoff from rains and spring thaws is high, wetland areas absorb excess water until it gradually drains away down streams and rivers and through the soil. Acting as buffers, healthy wetlands prevent flooding and erosion. In dryer periods, wetlands hold precious moisture after open bodies of water have disappeared.

The many activities that take place in wetlands make them among the most productive ecosystems in the world and as remarkable and resilient as wetlands are, these unique areas have limits. Their destruction and/or abuse can have devastating effects on wildlife, humans and overall environmental quality.

Many of the major attributes of wetlands can be explored through the use of metaphors. To use a metaphor is to apply a word or phrase to an object or concept which it does not literally denote in order to suggest a comparison between the two. A metaphor represents a concept or idea through another concept or idea. "A tree is a home" and "Books are windows of thought" are two examples. In this activity a variety of everyday objects are used to represent the natural functions of wetlands. For example:

OBJECT	METAPHORIC FUNCTION
Sponge	absorbs excess water caused by runoff; retains moisture for a time even if standing water dries up (e.g., sponge placed in a small puddle of water and absorbs water until saturated, then stays wet after standing water has evaporated)
Pillow or Bed	is a resting place for migratory birds
Mixer, Whisk, or Egg Beater	mixes nutrients and oxygen into the water
Cradle	provides a nursery that shelters, protects and feeds young wildlife
Sieve or Strainer	strains silt, debris, etc., from water
Filter	filters smaller impurities from water
Antacid	neutralizes toxic substances
Cereal	provides nutrient-rich foods
Soap	helps cleanse the environment

Wetland habitats are being converted to other uses (agriculture, roadways, housing developments) or otherwise being destroyed (drained for pest control or polluted) at the rate of about a half million acres per year. And although many wetlands are protected by federal and state laws, there still appears to be a significant need to create a greater understanding of the importance of wetlands as ecosystems and as wildlife habitat.

The major purpose of this activity is for students to develop an appreciation and understanding of wetlands through the power of metaphor, linking the characteristics and natural functions of wetlands to the familiar realm of everyday life.

PROCEDURE:

1. Prepare a "Mystery Metaphor Container" (pillowcase, bag or box). It should be possible for a student to put his or her hand into the container and pull out an object. You may want to collect as many as one metaphoric object per student, but at least have enough for one per group of four students. Put the container aside to use later.

2. Discuss the variety of wetlands found in your local area, state, country, etc. Then invite the students to sit quietly and close their eyes. Ask them to picture a wetland. Have them examine what it looks like. Have them look carefully at the plants and animals, including insects and small creatures. What does the air feel like? How does it smell?

OPTIONAL: *Play a tape recording of natural sounds from wetlands. Some are available commercially in record and nature stores.*

3. Invite the students to tell what they imagined. Compile a list of their offerings. Encourage discussion and mutual sharing.

4. With their list as a point of reference, help the students identify which plants and animals are actually most likely to be found in a wetland. If possible, have them classify the plants and animals according to the kind of wetland in which they would be found. State or federal wildlife officials and representatives of private conservation or nature-related organizations can be helpful. The series of golden nature guides from Western Publishing Company, Inc. are also useful. "Wading into Wetlands" from the National Wildlife Federation's NatureScope series includes a variety of useful information as well.

5. Next provide the students with background information to serve as an overview of the basic ecological activities that characterize the wetland habitat. For example, you can include the following:

- ♦ sponge effect - absorbs runoff
- ♦ filter effect - takes out silt, toxins, wastes, etc.
- ♦ nutrient control - absorbs nutrients from fertilizers and other sources that may cause contamination downstream
- ♦ natural nursery - provides protection and nourishment for newborn wildlife

Suggest that these activities and many more that they could probably think of are taking place in wetlands all the time.

6. Now bring out the "Mystery Metaphor Container." Tell the students that everything in the container has something to do with a wetland. Have the students divide into groups of four. Announce that when it is their turn, you want a representative of each group to draw an object from the container. Then, as a group, they must figure out how the object could represent what a wetland is or does.

7. Have the designated student reach into the container and withdraw one object. When each group has an object, ask them to work as a team to describe the relationships between their metaphoric object and the wetland. Encourage the students to build on each other's ideas. You can also assist by strengthening their connections.

NOTE: *Allow the students time to discuss their ideas with each other before doing so in front of the entire class.*

8. Ask each group to report their ideas to the class.

9. Following discussion and review of the functions represented by each metaphor, ask the students to summarize the major roles that wetlands perform in contributing to habitat for wildlife. List the ways in which wetlands are important to humans. Why do humans convert wetlands to other uses? Ask them if their own attitudes about wetlands are different now. If yes, how? If not, why not?

10. For the final part of this activity, encourage the students' understanding of how the wetlands' condition depends upon each of us. Many kinds of wildlife depend upon wetlands. Our own well-being requires wetland ecosystems. Strengthen the students' understanding of the connection that humans have to wetlands. Recreation, aesthetics, utilitarian uses, environmental quality and nature study are but a few of the connections we each have with wetlands.

EXTENSIONS AND ASSESSMENTS: (✱✱ extensions can also be used to assess the students' mastery of the learning objectives.)

- ❖ Personally visit a wetland to verify the appropriateness of the metaphors explored in the classroom. Identify and discuss any limitations to the appropriateness of these metaphors. Identify what seem to be the most compelling attributes of the metaphors in helping you understand the characteristics and nature of the wetland. Expand on your understanding of these metaphors. Identify new and appropriate metaphors!

- ❖ Investigate local, county, state and federal regulations and laws that govern uses of wetlands.

- ❖❖ Have students write an editorial about why wetlands should be preserved using information about how wetlands are important to wildlife and humans.

- ❖❖ Wetlands are important to a range of organisms in the animal kingdom, from zooplankton to humans. Select five species of animals and describe how wetlands are important to each.

- ❖ Explain why wetlands are called one of the world's most productive ecosystems.

For Younger Students:

- ❖❖ Have students draw pictures of a wetland, explain their drawings, and name three reasons why wetlands are important.

- ❖ Wetlands are sometimes called nurseries because so many young animals grow up in them. Name some animals that spend part of their lives in wetlands.

Life in the Fast Lane

SUMMARY: Students learn the benefits of, and challenges to, organisms living in temporary wetlands.

GRADE LEVEL: 3-8

TIME: 50 minutes

SUBJECTS: Ecology, Life Science

MATERIALS:
The following items (about one per student for each item) should be distributed around the school or in a playing field:
- snack food (e.g., hard sugar candies, peanuts, or crackers)
- toothpicks
- soil

Other items for scavenger hunt include:
- plastic cups or bags (3 per student)
- pins or tape
- paper

Optional: Prizes for successful scavengers

HANDOUTS:

➤ *Scavenger Hunt—Prey* (p.28)
➤ *Scavenger Hunt —Predator* (p.28)

LEARNING OBJECTIVES: Completing this activity will allow students to:
✔ describe physical and biological components of temporary wetlands.
✔ recognize the importance of temporary wetlands to larger ecosystems.
✔ explain how organisms in temporary wetlands race against time to obtain water, shelter, food; and a mate.

BACKGROUND:
With the addition of water, a once dry, dormant low area erupts with plant and animal life. These temporary wetlands usually appear during the wet season, then dry up later in the year.
In some parts of the country, such wetlands appear in the spring and are called vernal pools. Where do all the grasses, mosquitoes, and frogs come from? Buried in the soil, many wait for the essential ingredient that allows them to become active-water! Water collects in large puddles or wetlands when flatland soils become saturated with rain or snowmelt. Depending on topography and amount of precipitation, these wetlands may only be a few yards in diameter or they may cover an acre.

Water that collects in these wetlands either evaporates, percolates into the ground, or flows downstream. Consequently, these temporary wetlands rarely last through the dry season. A temporary wetland may exist for one day or up to four or five months. A whole world of life appears in such a wetland, with a fast-paced lifestyle designed to win the race against time-the time when the wetland dries up. During this limited time, organisms such as mosquitoes, salamanders, frogs, toads, fairy shrimp, and microorganisms must secure shelter, find food, locate a mate, and reproduce.

One benefit of living in a temporary wetland is the concentration of food sources (algae and other plant species). This rich supply of food makes these wetlands an attractive home and a productive nursery for many animals. Some species (e.g., fairy shrimp) are found primarily in temporary wetlands, and their existence depends on these pools. If they lay their eggs or deposit their seeds before the wetland dries up, their offspring will be born when the water returns next season. Other organisms bury themselves and become dormant when the water dries up (in some cases, for as long as 20 years!). Other animals are transient residents (e.g., visiting during migration) and relocate when the wetland disappears. In this way, temporary wetlands contribute to larger, permanent ecosystems, such as deserts or forests.

PROCEDURE:

1. Have students write a paragraph describing an area of their neighborhood that retains water on a temporary basis. Explain that this collection of water might be classified as a temporary wetland. Have students share what they know and think about wetlands and list how temporary wetlands could be important to the environment.

2. Tell students they are going to participate in a scavenger hunt to simulate this race against time. Explain that they are organisms living in a newly formed temporary wetland.

3. Have students count off by fives. Tell all number ones to write the word predator on a piece of paper and pin it to their shirts. Predators, which eat insects and other organisms, include frogs, salamanders, and turtles. The rest of the students are prey organisms, such as insects, crustaceans, etc.

4. Tell students the temporary wetland will dry up in a specified amount of time. Players must search their school or playing field to acquire what they need to survive. The amount of time will depend on the size of the school or playing field and the distribution of items. Start with a ten-minute time limit.

5. Distribute *Scavenger Hunt (Prey)* and *Scavenger Hunt (Predator)* and plastic cups to students. The four main categories are water, shelter, food, and a partner. Students must obtain all items in one category before they can begin to fill the next. That is, all items in one category must be brought to the classroom and initialed on the scavenger sheet. The first three categories can be completed in any order, but all three must be completed before students can identify a partner.

6. Warn students that they must avoid predators while scavenging. If they are tagged by a predator, they become the food of the predator. The prey must stop searching and travel with the predator.

7. After students acquire partners, they return to the classroom and have their scavenger sheets finalized. All students must return once the allotted time has elapsed.

8. Set the timer and release students. Departures of predators and prey should be staggered to give the prey time to scatter. Prizes can be awarded to students who return within the time limit.

9. Discuss the outcome of the scavenger hunt. What might be the fate of organisms that do not obtain what they need before the wetlands dry up? Have students summarize the challenges of living in temporary wetlands. Explain that, despite such limited time, one advantage over permanent water bodies is that food and shelter are generally more accessible, with predators less common.

10. Have students discuss how wetlands could benefit their community. Why might people want to eliminate temporary wetlands? Compare students' comments in class discussion, to identify differing points

of view. Local governments or state resource agencies may be interested in students' findings.

EXTENSIONS AND ASSESSMENTS: (✵✵ extensions can also be used to assess the students' mastery of the learning objectives.)

- ❖ Compare the longevity of several wetlands during the same season. Explain differences.
- ❖❖ Students may be interested in researching how human actions can protect or endanger temporary wetlands.
- ❖❖ Have students research and write a report about one of the animals that lives in or visits a temporary wetland.
- ❖❖ Have students write a letter about the importance of temporary wetlands to both wildlife and humans and how human actions can protect or endanger temporary wetlands. Send the letter to the local newspaper or government official.

Used with permission from The Watercourse/Montana State University and the Council for Environmental Education (CEE). For the complete Project WET activity format, see "Life in the Fast Lane" from the Project WET Curriculum and Activity Guide. *For further information about Project WET (Water Education for Teachers), contact the national office at (406) 994-5392 or fax (406) 994-1919.*

Scavenger Hunt (Prey) Name: _____

WATER Teacher initials	Three cups of water
SHELTER Teacher initials	A toothpick and some soil
FOOD Teacher initials	Four pieces of food (such as one hard candy, one piece of chocolate, peanut, cracker)
PARTNER Teacher initials	A partner (the first student you see who has found water, shelter, and food)

Scavenger Hunt (Predator) Name: _____

WATER Teacher initials	Three cups of water
SHELTER Teacher initials	A toothpick and some soil
FOOD Teacher initials	Eight pieces of food. The actual food items (hard candy, chocolates, peanuts, crackers) count as one piece each. Students (prey organisms) represent two pieces of food each. You can scavenge eight pieces of food or four prey students, or any combination of food pieces and students to equal eight pieces. (For example, three prey students and two pieces of food equal eight pieces.)
PARTNER Teacher initials	A partner (the first student you see who has found water, shelter, and food)

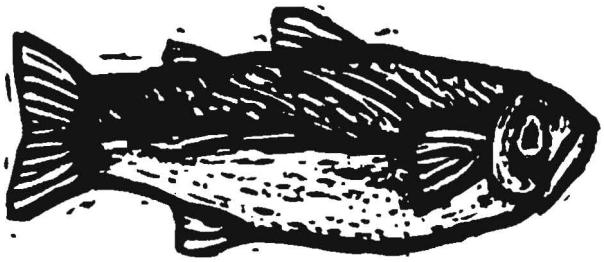
Marsh Mystery

SUMMARY: Students read a mystery story and, to solve the mystery, play a game that demonstrates bioaccumulation.

GRADE LEVEL: 5-12

TIME: 30-45 minutes for each section

SUBJECTS: Environmental Science, Government



MATERIALS:
Based on a class of 25; adjust numbers to fit class size.
- 25 paper plates or large paper strips for labels
- tape or string
- scissors
- magic markers
- 32 red construction paper tokens (2-inch squares)

HANDOUTS:

➤ *The Mystery of Sandy Bottom Creek* (p.32)
➤ *Possible Solutions for New Port City and Cedarville* (p.33)

LEARNING OBJECTIVES: Completing this activity will allow students to:
✔ be introduced to the concept of bioaccumulation.
✔ discuss factors contributing to pollution of resources.

BACKGROUND:
Bioaccumulation or biological magnification is the process by which pollutants build up in the bodies of consumers in the food web. An example: plants (primary producers) are sprayed with a pesticide. Insects (primary consumers) eat the plants and ingest the pesticide. Some die, others are eaten before the pesticide kills them. A bird or other animal (secondary consumer) eats several insects, thereby taking in the pesticide. This consumer's body now contains a quantity of pesticide equal to the amount taken in by an insect multiplied by the number of insects and plants it ate. A predator or scavenger (tertiary consumer, or third in the chain) now eats a few of the secondary consumers, and the pesticide is further concentrated in its body.

This is how we sometimes destroy entire populations of wildlife and can endanger human health as well. For example, before the pesticide DDT was banned, bald eagles were driven nearly to extinction from its effects.

PROCEDURE:

1. Ask students what happens when certain toxic substances are introduced into the food web.

2. Read *The Mystery of Sandy Bottom Creek* to the class (you may want to give them copies so they can read along). On the board, draw a map of the situation as you read.

3. Ask students if they can solve the mystery. How did the boy become ill? Could it be from something he ate? Give the students this hint: There is a man in New Port City who earns his living by catching fish in the Johnstown River and selling them to markets throughout the region.

4. Explain that each student will represent a component of the King's Folly marsh ecosystem. Give students paper plates or strips and have them label their plates or strips as follows: four students are cattail plants, one is a muskrat, one is a mouse, one is an eagle, ten are shellfish, five are small minnows, two are large bass, and one is a person. Have the students tape their labels to their clothing or tape loops of string through them so they can be worn like a necklace. (For older students, you may want to assign animal identities and diagram the proceedings on the board.)

5. Start at the "bottom" of the food web to try to uncover clues to this mystery. Remind the group that it is known that the pesticide did get into the water that flows through King's Folly Marsh on its way to New Port City, and that the class members represent things that live in the marsh.

6. Ask the cattails (primary producers) what they need to survive (soil, water, sunlight, air). Tell them that as cattails take up water, they are also taking in the pesticide. Give each of the cattails three tokens (red squares) to represent the pesticide concentration they contain. Have them tape the squares to their plates or labels.

7. Ask which of the animals would eat the cattails? Cattails that are eaten by the muskrat should give their tokens to the muskrat; those eaten by the mouse should give their tokens to the mouse. (All the cattails should be eaten.) How many tokens do each of these animals now have? Since the mouse and muskrat ate the cattails, anything in the plant tissue was also eaten, and is now in their bloodstreams and bodies.

8. Ask who would eat these animals? Have the muskrat and mouse give all of their tokens (12) to the eagle, who now has this much of the pesticide in his body. Have the eagle tape the 12 tokens to his label. This is enough to kill him.

9. Now give each of the shellfish two tokens. Explain that shellfish feed by filtering tiny bits of plant and animal material out of the water. In this way, they also have taken in some of the pesticide.

10. Ask which of the remaining live animals would eat these shellfish. Have the minnows eat two shellfish each and take in their pesticide tokens.

11. Next, have the bass eat all of the minnows and take their tokens.

12. The person (perhaps someone living in New Port City who caught fish from the Johnstown River or bought fish from the fish merchant) then eats the two bass, takes in all 20 tokens and tapes them to his label. Ask if this enough to make a person ill. Explain that this is a simplified demonstration of a natural process called bioaccumulation or biological magnification. Substances that accumulate (build up) in organisms work their way through the food web

13. Ask students to review the process by describing what happened in the demonstration. Read the story again. Make a list on the board of all the clues to the mystery and have the class answer the following:

❧ **How did the people get sick?** Bioaccumulation of the pesticide caused the sickness. The sick people ate fish caught in the Johnstown River. These fish fed in the marsh, a drainage area for the Cedarville farms, before they moved downstream to the river. Some of the contaminated fish were sold in New Port City, while others were sent to a market in the state to the north.

❧ **Why didn't the people in Cedarville get sick?** Cedarville kids fished and swam in Sandy Bottom Creek north of town, upstream from the runoff from Cedarville farms. King's Folly Marsh is downstream from the farms, and so was contaminated when the pesticide washed down and accumulated in its sediment (silt and soil), water, plants, and fish. If the citizens of Cedarville had eaten the marsh fish, they would have become sick, too.

❧ **Why didn't the water test show dangerous levels of pollutants?** The marsh filtered out some of the pollutants, so the water that flowed on to the Johnstown River was not badly contaminated. The marsh wasn't able to filter out all of the pesticide, however, so the chain of bioaccumulation began.

❧ **When pollutants wash away, are they really away?** Is the problem gone? Is the presence of the marsh part of the problem? No! Discuss the benefits of having the marsh there (helps filter pollutants; provides food and cover for valuable animals- animals that give us food and jobs, and animals we just enjoy seeing.) If people did not pollute, problems such as the one in the story would not occur.

14. Ask students if this situation could happen in their neighborhood. Have them research their community to find potential sources of pollution that could accumulate in the environment. Have students consider possible solutions to the problems they discover. Students may ask:

❧ How does the local landfill dump control leakage of chemicals? Does the community offer separate hazardous waste collection and storage?

❧ Do farmers in the area use buffer strips (areas of trees, shrubs, or even wetland vegetation between tilled land and waterways) or other methods to filter farm runoff?

❧ Are methods of filtration used on runoff from streets and parking lots? (One method uses stormwater management ponds that allow sediment and attached chemicals to settle out of the water.)

❧ How can I work to prevent pollution? Organize a community-wide planting day to add a buffer zone (filtering area) to the edges of waterways, or even around parking lots. Plant a wetland! (See Appendix.) Encourage friends and neighbors to keep pollutants off the land and out of waterways by using and disposing chemicals carefully and according to package directions. Some chemicals break down rapidly into harmless, common compounds. Read labels to find out about products' safety and contact the manufacturer for information if necessary. Become more aware of how certain chemicals react in the environment and purchase and use the safer ones. That is, be a wise consumer!

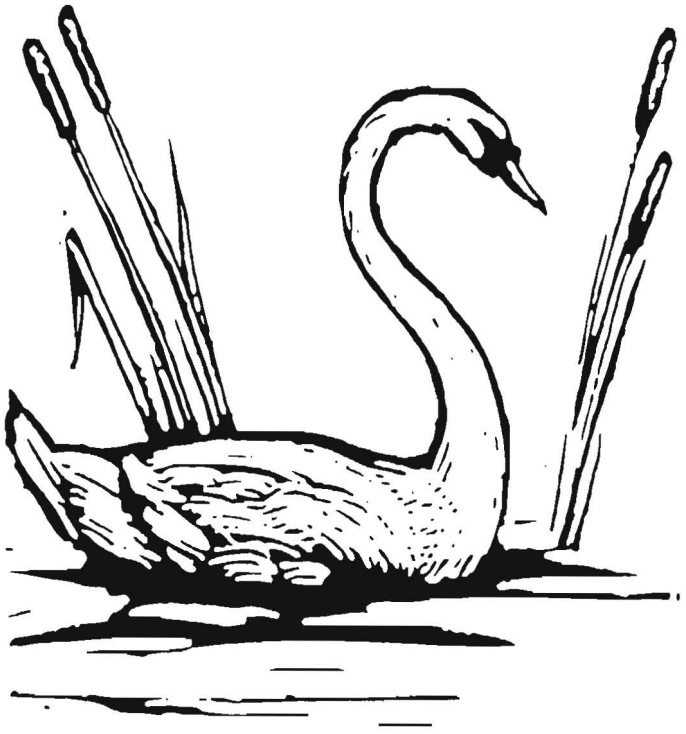
EXTENSIONS AND ASSESSMENTS: (✱✱ extensions can also be used to assess the students' mastery of the learning objectives.)

- ❖ Have students diagram how pesticide runoff can contaminate food sources and propose and evaluate solutions to a seafood contamination problem.

- What could people in the story do to solve their problem? Give students copies of the possible solutions listed below. Ask students to take the different roles mentioned in the story (one health official, several townspeople, the sick boy's mother, etc.) and decide which solution each would prefer. Discuss these solutions and others that the students propose. With some guidance, this could turn into a healthy debate.

- Have students vote on the solutions or work together to propose a compromise. Advanced students may wish to debate and vote on solutions at a mock town meeting. The class will probably be divided over these issues. How are issues like these settled in real life?

This activity was reprinted with permission from "Marsh Mystery" pages 116-119 in: WOW! The Wonders of Wetlands, *1995. Published by Environmental Concern, Inc., St. Michaels, MD (410) 745-9620 and The Watercourse, Bozeman, MT (506) 994-1917.*



The Mystery of Sandy Bottom Creek

Sandy Bottom Creek, a small tributary, flows through a rural town called Cedarville. The people of Cedarville are mostly farmers who have worked the land since the area was settled in the late 1600s. Cedarville is a small community. Its residents know each other well and often work together to protect the area's resources.

In the summer the children of Cedarville swim and fish in Sandy Bottom Creek just north of town, at a spot where the water is deep. Cedarville residents say, "Many a summer supper came to our table from the idlings of our youngsters! Seems Sandy Bottom's been feedin' our families since time began."

The creek flows through a great marsh on its way out of town. This marsh is called King's Folly Marsh because, before the area was settled, the King's men (English soldiers) took a shortcut through the marsh on their horses and got stuck in the mud!

King's Folly teems with animals and is alive throughout the year with colorful insects, herons, egrets, ducks, muskrats, and many kinds of fish. Last year the Cedarville town picnic was held just outside the marsh, since the scenery there is so beautiful.

This fall, the citizens of Cedarville are up in arms about an alarming and mysterious set of circumstances. It all started when a health official came from New Port City, an urban area bustling with industry and port activities that lies downstream (south) of Cedarville, where the creek joins the Johnstown River. The official said a small boy had become quite ill in New Port City, and a test showed dangerous levels of a pesticide byproduct in his blood. Cedarville farmers use this pesticide in their crops. The case is a mystery: the boy has never visited Cedarville and has never even left his neighborhood in New Port City.

New Port City's drinking water was tested, and not a trace of the pesticide was found. The unfiltered water from Johnstown River was tested. A small amount of the pesticide was found, but this was expected since runoff from Cedarville farms is known to contribute small quantities of pollutants to Sandy Bottom Creek. So how did this poison get into the boy's blood?

In the state north of Cedarville, several people have also reported mild cases of a similar disorder. Yet Cedarville is the only town in the region that uses the pesticide.

The town has called a meeting to discuss the problem. The citizens are concerned about their responsibility in the matter and also worried that they won't be able to use this chemical anymore to protect their crops. They feel this pesticide is the best one ever developed. They've used it for two years and there has never been a problem. Has there been some mistake?

No illnesses were reported during the summer, when people were eating the tomatoes and corn grown in Cedarville, and none of the crops were shipped out of state. If the pesticide is making people ill, why haven't the people who have eaten crops grown in Cedarville been affected? No one in Cedarville has gotten sick-though one man did report finding a dead eagle near his farm south of town.

Possible Solutions for New Port City and Cedarville

1. Make the man in New Port City stop catching and selling fish there. How would this affect the man?

2. Stop all fishing in the Johnstown River and Sandy Bottom Creek. Who would this affect and in what ways?

3. Make the farmers in Cedarville stop using the pesticide. What should they use instead? Have someone play the role of the pesticide manufacturer.

4. Install good pesticide management practices on the farms. Plant wide strips of trees, shrubs, and other plants along the borders between farm fields and waterways to trap eroding soil and pollutants. Who would pay for this to be done?-the farmers or the town, state, or national government? Many of the farmers would lose a piece of their cropland for this purpose. How would they be compensated (repaid) for the cropland lost?

5. Write new or stronger laws to regulate the use of pesticides near waterways. What would the regulations say? How would each of the characters react to these new laws?

6. Have the Health Department or other government agency of New Port City test the water and the fish periodically for toxic levels of pollutants. They should then publish a notice or warning to let people know when to avoid the fish or the water. Would this cause undue alarm in the citizens? What would happen to merchants who sell fish in the city?

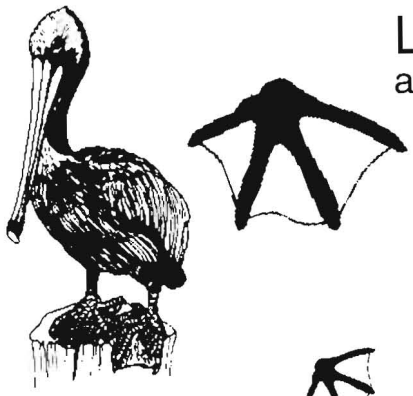
7. Do not let the children of Cedarville fish in or near King's Folly Marsh. Make sure they continue to fish upstream from the marsh. Is this an effective means of avoiding contaminated fish? Why or why not? Is this the best approach to natural resource management? Is this treating the symptom or its cause?

8. Fill in King's Folly Marsh and make it a landfill (dump), since pollutants are going there anyway. What effect would this have on the environment and its inhabitants (people, too)?

Animal Tracks® Kids' Page

Welcome to Animal Tracks!

Learn more about the environment and what you can do to make a difference.



Just follow the tracks...

IS A WETLAND ANY PLACE THAT'S WET?

Wetlands are wet (though some are wet for only part of the year), but so are oceans, rivers, lakes, and streams. What makes a wetland a wetland is large amounts of waterlogged soil with a relatively shallow layer of water. Bogs, marshes, and swamps are some examples of wetlands but there are many other kinds. Wetlands can have fresh or salt water and serve many important functions for wildlife and people.

WETLANDS AS HABITAT

Acre for acre, there's more life in a healthy wetland than there is in almost any other kind of habitat. These productive places can support huge numbers of plants, insects, fish, birds, and other animals. Many species of fish, crab, and other creatures spend their young days in wetlands before moving as adults to larger bodies of water. Migrant birds find a safe resting spot and place to refuel on a rich food supply in wetlands.

VALUE OF WETLANDS

Wetlands provide many vital benefits to people. They work as natural flood busters. An easy and cheap way of controlling floods is to leave wetlands in their natural state. Wetlands trap silt that might otherwise move on to clog rivers, lakes and other bodies of water. They also lessen storm damage by acting as a natural buffer between the wind and the waves and the area beyond.

FUN FACTS: Did You Know?

- Over 1/3 of the animals and plants listed as threatened or endangered in the U.S. either live in wetlands or depend on them in some way.
- Cranberries, mint, cattails, wild rice, watercress, and some shrimp are all harvested from wetlands.
- The prairie pothole region stretches from the Midwest of the US into Canada and is scattered with deep and shallow marshes and wet meadows. Millions of ducks and other animals depend on prairie potholes as feeding, nesting, and resting sites.

Wetlands Word Search

Can you find the following wetland words?
Swamp, Cattail, Crab, Mussel, Marsh, Muskrat, Beaver, Dragonfly, Fish, Frog, Duck

C I U P M A U T S L A S F
Z A S M G Y S O W P E I O
Y F T A R O W N A K S L D
L S F T B X N K M H A E F
F A R H A E E B P S R O T
N U O S V I L E R L A N A
O E G R E N L A Y T V P R
G L B A D W O V Q A M Z K
A M A M U S S E L B U C S
R I R E N M Y R Z Q I A U
D U C K Q I A T E Z D S M

Action: Things You Can Do !

- Help educate those around you about the importance of protecting wetlands. Write a report for your class telling about the vital role of wetlands in our world.
- Write a letter to your senator or representative and tell them you care about preserving wetlands.
- Explore the wonderful world of wetlands. Visit a wetland near you and count how man different plants and animals you see.

The new full-color Animal Tracks book contains more games, puzzles, information and activities about conservation issues. Order your copy from the National Wildlife Federation. Have an adult call 1-800-477-5560.

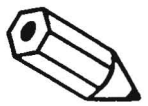
Adapted by Sara Bradley from the Wading Into Wetlands issue of NatureScope published by the National Wildlife Federation, 1992.

ACTION

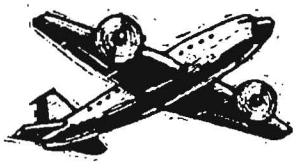
"Conservation is a state of harmony between men and land."

- Aldo Leopold,
The Land Ethic

Action Notes...



Taking Action



Getting Started

Participating in student-driven action projects is an important means of helping students develop a strong connection to the environment. An action project that focuses on improving the local environment will let students experience first-hand how they can make a difference. By accomplishing something tangible that addresses a community concern, students gain both a capacity for action and citizenship skills. An added benefit is the many connections between action projects and the curriculum. Environmental issues and project organizing skills can be connected to many subject areas, often enhancing the requirements by providing real-world examples and integrated lessons that cross disciplines.

Two important keys to success are **focusing on your local community** and **involving students in every aspect of the process.** Directing your efforts to a problem in the local area will make students active participants in the future of their communities. The benefits of a local project can be more easily seen and understood. By allowing students to direct the project and determine the focus of their efforts, they gain a sense of ownership of the project and its outcomes.

Determining how to get started on a project is often the hardest part. The following information provides a basic guideline for steps involved in organizing a project, as well as some tools for accomplishing each step. Please refer to the resources section for other references with details on project organizing.

Role of the Teacher

Let your students take charge of their own projects: Projects will be less effective if the teacher alone chooses the focus of the project. Instead, encourage your students to become involved and use their creativity to develop a project plan that works for everyone. This will both develop student leadership skills and encourage your students to take part in the project using their own unique abilities. In this role, you will be serving more as a mentor, guiding and assisting your students participation in the project.

There are many ways to approach action projects: Most projects can be done at many levels: from very simple to quite involved. To make the projects as beneficial as possible, tie the projects into the curriculum and set learner outcome goals for your students involvement in an action project. For example, by stating a goal of learning how to identify plants, a garden activity will expand students' horizons beyond just learning how to plant vegetables.

Think broadly about how the project will fit into your curriculum: Action projects can touch on a wide range of student skills including language arts skills like oral communication and report writing; math skills like mapping, estimating, and problem solving; and science skills like modeling, observing, and predicting. Specific subject areas can also be tied into the action project as appropriate, so student knowledge can be developed using local issues. When meeting your requirements through the more hands-on approach of an action project, the level of student interest and motivation will help to increase learning.

Keep the project moving: Perhaps the most important role of the teacher is to help students overcome obstacles. The scope of an action project should be realistic—sometimes you may need to keep your students open to other options in case their initial strategy doesn't work. Refer to the steps in the "Implement Plan" stage for more guidance.

Follow the Tracks to Action

Taking part in an action project is a creative process, unique to each situation. The steps below are designed to give guidance on how the process might work, but the process will differ from project to project. The steps include information on how to determine what is needed in your community, how to bring out diverse skills in your students and get them involved, and how to make an action plan.

By involving students in the planning steps, they are engaged from the start. This up-front preparation process can serve as a lesson for students in itself, focusing on skills such as interviewing, making time lines, budgeting, and organizing. Also, remember that investing time in planning is critical to project success.

There are four stages to taking action in your community:

- ❒ **Take Inventory**
- ❒ **Make a Plan**
- ❒ **Implement Plan**
- ❒ **Reflect and Evaluate**

Going through these stages in sequence will help your group tackle an environmental concern in your community and learn from the process while meeting your curriculum requirements. In each stage, there are steps and tools to help you implement the plan. These steps and tools are offered as guidance and can be used however they work best for your particular group's needs.

Stage I - Take Inventory

Identify concerns in your community that indicate an environmental problem and determine resources to which you have access both among students and within the community.
This will involve:

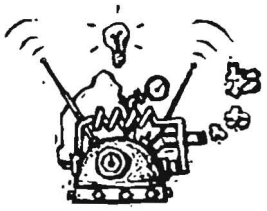
1. **Determining a project area**
2. **Finding local community resources**
3. **Conducting a needs inventory**
4. **Identifying student skills**

1. Determining project area: Identify a place to focus your efforts.

❁ Use a map of your community and students' knowledge of the area to find possible project locations that are nearby in the community. In addition to your school campus, possible locations include parks, churches, community centers, and natural areas such as rivers, streams, and wetlands.

❁ Make sure the place is convenient, accessible, and safe. The place should also offer some opportunities for improvement. If your community is fairly small, you may want to look more broadly and decide to focus on the community as a whole. It's still important to define the boundaries of the area you want to investigate more closely.

❁ Share your educational objectives with your students, then have them visit each location and vote on the one they like best.



2. Finding local community resources: Brainstorm—list all the people and organizations within the community who may help with the project.

❁ Have students list everyone to whom they have access since it's difficult to anticipate what sorts of resources you will be able to use with your project. Don't worry now about how to use these resources. You can take advantage of what you've identified in your community during the project implementation. *Examples of local community resources*: a local university's Department of Ecology, the hardware store next to the school, a parent who works for the Chamber of Commerce, and the 4H club.

❁ Find people and groups with knowledge that might relate to your project, sources of materials, and sources of labor.

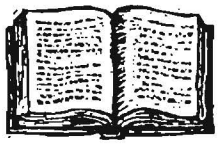
❁ Get parents and other key community members on board. Explain what you are doing beforehand in order to secure their support for involving students in action projects.

Stage IV - Reflect and Evaluate

Completing a successful project is something to celebrate. It's important to end the student's experience with a chance to reflect on and evaluate what happened. Take advantage of your accomplishments and get some recognition for your students and school. This will involve:

11. Reflecting on the project
12. Evaluating the project
13. Getting recognized

11. Reflecting on project: In order to enhance the students' understanding of what they accomplished, take time to get together as a group and process what happened. Use the ⇨**Sample Reflection Questions**⇦ sheet on p. 55 to guide your discussions.



❄ Schedule discussions throughout the project as well as at the end of the project. You should also encourage students to document their thoughts in a journal.

❄ Having a group discussion will give students the opportunity to listen to other thoughts on the experience, perhaps hearing a new perspective.

❄ Focus on how students changed their thinking or behavior as a result of the project. Often students will be surprised at things they learned or changes in themselves.

❄ Make sure everyone has a chance to share and allow students multiple options for sharing their experiences. Public speaking, journal writing, hands-on activities, and performing arts are some examples of approaches. These reflection activities will allow you to assess your students' performance as well.

❄ Allow students time to respond to the questions. This will give them a chance to organize their thoughts.

12. Evaluating the project: In addition to processing the project on an experiential level, it is probably a good time to assess what happened, what your students learned, and possible improvements for the future.

❄ Have students evaluate each step of the project. Discuss how to give constructive feedback and focus the discussions on how well your group accomplished the original project objectives.

❄ Use journals, videos, photos, or other materials collected during the project as a springboard for discussions on the environmental issue your group worked to improve. Talk about what the students learned and how their thinking has changed during the project process.

❄ Ask community members who were involved with the project to evaluate the group's project. Initiate discussions by sharing videos or scrapbooks from the project. Another option is to develop a form or survey questions to assess what worked and didn't work.

❄ Spend time to determine how to keep the project going. Keep up your network of community contacts to maintain a successful project that will last into the future.

❄ Discuss what else your group can accomplish. Now that you have a team mobilized with a variety of skills and contacts, it should be easy to build on your initial project.

13. Getting recognized: You did it! Wrap up the project by getting more recognition for your final project.

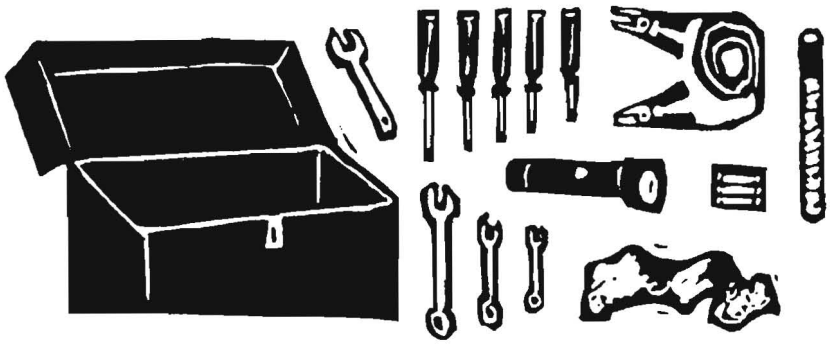
❄ Use the information you gathered previously (statistics, photographs, letters) to tell everyone you can about what the group accomplished.

❄ Send a press release to the local newspaper or television station, hold an awards ceremony for the participating students, and publish in-print and on-line the story of what happened.

❄ Get in touch with nationwide awards programs that recognize environmental projects. (See page 68)

Action Tools

The following pages contain the action tools referenced in the action steps. Each tool is designed to be copied and distributed to your students.



Sample Inventory Questions

Note: Many of these questions will require brainstorming to determine strategies for finding the answers.

I. Water Quality

- How many concrete or blacktop surfaces such as playgrounds or parking lots that allow water to run off into the street and storm sewers are in your community?
- How are construction or other bare areas managed to prevent soil from being washed down storm sewers? Are erosion control measures required on construction sites in your area?
- Has local drinking water been tested? For what contaminants (lead, bacteria)?
- What is the maintenance plan for parks or gardens in the area in terms of the amount of pesticides and fertilizers used?

II. Preserving Natural Areas

- What impact do people have on natural areas when used for recreation purposes such as hiking, biking, boating, or picnicking?
- Does your community protect and preserve wildlife habitat such as wetlands, forests, or prairies?
  - Does the community have a land-use plan which specifies which areas will be kept natural or as greenways?
  - Do more areas need to be added? Get more information from the office of permits/inspections/building/planning or the conservation district office on these questions.
- How extensive is the use of native trees, shrubs and grasses on community and school grounds? Do these areas use landscaping that provides food, water, and shelter to attract wildlife?

III. Water and Energy Conservation

- How are homes and businesses insulated and weatherproofed to keep energy consumption at a minimum? What energy conserving techniques are people using (i.e. turning off appliances when they're not being used and adjusting the thermostat for the air conditioner up and heat down when people aren't around)?
- Is watering of lawns, parks, or gardens being done in ways that ensure water isn't wasted?
- What water conservation techniques do homes/businesses use (i.e. low-flow shower heads and aerators on the faucets)?

IV. Air Quality

- What forms of alternative transportation are available in your community?
- Are there areas that have been cleared of trees for construction projects? What tree planting efforts occur in the community?

V. Waste Reduction

- Are there locations where people can recycle (aluminum, plastic, glass, newspapers, oil)? Are these easy to find and use?
- What products made from recyclable materials do stores in the area sell?
- Does your community/school buy materials made with recycled content? Can these efforts be increased?

VI. Environmental Awareness

- Does your community educate citizens about conservation in the home and yard? How can this be improved?
- Is environmental education incorporated into your school?
  - Are environmental topics covered in your classes?
  - Are there environmental clubs at school?
  - Do you have a school nature area where you can do experiments and study and enjoy nature?
- How does your school or community celebrate Earth Day, National Wildlife Week, Arbor Day, National Drinking Water Week, Wetlands Month, National Beach Clean-up Day, or other environmental awareness days?

Sample Project Inventory Checklist

Issue: *Waste Reduction*

1. Question: *Are there locations where people can recycle (aluminum, plastic, glass, newspapers, motor oil)? Are they easy to find and use?*

   What we found out: *Recycling bins for glass, aluminum, and plastic in the cafeteria. Paper recycling in the hallways. No place to recycle newspapers.*

   Possible solutions: *Set up bins for newspaper.*

   ☒ We need more information about: *Does recycling company collect newspaper?*
   Priority ① 2 3

2. Question: *Does school store sell products made from recyclable materials?*

   What we found out: *Store only sells recycled notebooks.*

   Possible solutions: *Could sell recycled folders, notebook paper, rulers, and pencils.*

   ☒ We need more information about: *Prices of recycled products.*

   Priority 1 ② 3

3. Question: *Does your school have a policy of buying materials with recycled content?*

   What we found out: *All paper for copy machine is recycled--this is county policy.*

   Possible solutions:

   ❑ We need more information about:

   Priority 1 2 ③

4. Question: _____

   What we found out:

   Possible solutions:

   ❑ We need more information about:

   Priority 1 2 3

Project Inventory Checklist

Instructions: Pick the issues you want to focus your investigation on. For each issue you choose, brainstorm inventory questions—use the list of sample questions to get you started. Prepare the inventory checklists by filling in the issue and the questions. Then work in groups to answer the questions for each issue. For each question, note what your group found out and possible solutions. If your group can't answer the question completely, check the box indicating that "we need more information" and list ideas for further investigation. Continue for all of the questions until completed. Then for each issue, rank the items by their importance as an issue that needs attention with "1" indicating the most pressing problems and "3" indicating the least important ones.

Issue: _____

1. Question: _____
   What we found out:

   Possible solutions:

   ❑ We need more information about:

   Priority 1 2 3

2. Question: _____
   What we found out:

   Possible solutions:

   ❑ We need more information about:

   Priority 1 2 3

3. Question: _____
   What we found out:

   Possible solutions:

   ❑ We need more information about:

   Priority 1 2 3

4. Question: _____
   What we found out:

   Possible solutions:

   ❑ We need more information about:

   Priority 1 2 3

Sample Choose a Project

	Priority Environmental Needs (identified problems)				
What We Know How To Do (Skills and community resources)	Set up recycling bins in park	Organize an alternative transportation day	Build bat boxes		
drawing	X				
using Internet	X	X	X		
riding bikes		X			
talking on phone	X		X		
working in woodshop			X		
watching backyard wildlife			X		
sewing					
reading	X	X	X		
driving bus (Wyatt's dad)		X			
hardware store (David's mom)			X		

Choose a Project

Instructions: List all the skills and community resources you identified earlier in the column "What We Know How to Do" on the left side of the chart. Then, take the problems identified as priorities in each category of the Project Inventory Checklist and write them along the top of the chart in "Priority Environmental Needs". See where the student and community skills and resources in "What We Know How to Do" match up with the "Priority Environmental Needs" and put an "X" in the box. *Example: if a priority environmental need is creating an educational display and one of the student skills is art, put an "X" in the box where the two things meet.* The projects that have the most "X's" in their columns are the ones that best match your students' skills.

	Priority Environmental Needs (identified problems)				
What We Know How To Do (Skills and community resources)					

Sample Action Plan

Environmental Project: *Building bat boxes*

Group Name: *Room for Bats*

Project Goal: *Build bat boxes to encourage bats to nest on school campus.*

Project Start Date: *2/1/98* **End Date:** *4/20/98*

Specific Project Tasks	Completion Date	People Responsible	Materials/Funding Needed
Choose a site.	2/15/98	Elenor, Jean, and Linda	None.
Research bats and how to make bat boxes.	2/28/98	Sara and Joe	Library. Postage for letters.
Map site and determine location of bat boxes.	2/28/98	Joe, Margaret, and David	Art supplies for map.
Get materials and tools to build bat boxes.	3/15/98	Mitchell and Jennifer	Wood, nails, and tools. Estimate $75 with borrowed tools.
Build boxes.	4/1/98	Everyone	None.
Put boxes up.	4/8/98	Cheryl, Ronald, and Mr. Nelson	Nails and ladder. Estimate $5 with borrowed ladder.
Watch and record data about bats using boxes.	ongoing	Everyone	None.

Action Plan Worksheet

Instructions: Write down the name of your project and the name of your group on the worksheet. List your main goal next to "Project Goal." Document when you can start on the project and the end date when the project needs to be completed. Break down the overall goal into smaller tasks and organize the tasks by priority, with what needs to be done soonest first. List each of the tasks in order on the "Specific Project Task" column. Go through the list of tasks and write a target completion date for each one. For each task determine who will be responsible for which task and what materials and funding are needed and list this information in the appropriate columns of the worksheet.

Environmental Project:
Group Name:
Project Goal:
Project Start Date: **End Date:**

Specific Project Tasks	Completion Date	People Responsible	Materials/Funding Needed

Sample Reflection Questions

Reflection questions are usually open-ended. For example....

- What happened when...?
- How did people respond to you?
- What did it feel like when?
- What did you feel good about?
- What did you learn as a result of...?
- How can you use what you've learned?
- What academic skills or information did you use?
- What would you like to know more about?
- Where is this situation likely to occur in the future?
- What would you do differently?
- What advice can you pass on to others?
- What was your biggest challenge?
- How did you solve a problem?
- Why was there a need for your service?
- What could be done to solve the problem permanently?

Sample reflection questions were adapted from Learning by Giving, from the National Youth Leadership Council, St. Paul, MN 55113. For more information call 612-631-3672.

Project Ideas

❖ Find out as much as possible about wetlands in your area.

❖ The best way to study a marsh, bog, swamp, slough, or estuary is to visit one. Chances are there's a stream, lake, pond, or ocean with a surrounding wetland near your school.

❖ Borrow a field guide form the library and write down the types of trees, plants, and animals you see there. The librarian may also be able to get you in touch with local organizations that support the wetland and its inhabitants.

❖ Be a considerate guest. Marshes, swamps, bogs, and other wetlands are home and refuge to many plants and animals. When visiting a wetland, respect the inhabitants. Stay on marked trails and do not take home souvenirs. If you must listen to music, wear head phones. Restrict your voices and movements. Pick up trash and discard in receptacles. It's also a good idea to leave pets behind; free roaming dogs and cats can be very detrimental to wetland wildlife.

❖ Avoid using substances that can pollute wetlands. Pesticides, motor oil, harmful cleaning products, and other caustic substances devastate nature when disposed of improperly. Wetlands receive water from rain and run-off. If streets are littered with oil, garbage, gasoline, and animal feces, there's a good chance that these pollutants will be washed into the wetland. Clean up after your pets and avoid using harmful products whenever possible. Your local department of water or waste management will be able to tell you how and where to safely dispose of toxic trash.

❖ Reuse, reduce, and recycle. The fewer resources we use, the less we impact we make on our environment. Wetlands have been referred to as "smelly wastelands" and turned into garbage dumps and other landfills. Try to reduce the amount of trash you throw away and the amount of water you use; use washable cloth napkins instead of paper; repair broken items instead of throwing them away; and recycle everything possible. Encourage others to do the same.

❖ Host a recycling drive at your school. Besides cans, bottles, plastic and paper, you can collect old household items for donation to needy organizations.

❖ Contact and join forces with an organization that is helping to preserve wetlands. Most environmental groups and nature centers operate on very limited budgets and depend on volunteers to support their cause. Inquire whether they are planting trees and plants, holding a fund-raiser, hosting a walk, staging a clean-up, or writing or mailing promotional flyers. Tasks are generally numerous and varied, so there should be something to interest and make the best use of all your students' talents.

❖ Stay informed. Read newspapers, follow the media, attend community gatherings, and look for public announcements about events that may impact your local wetlands.

❖ Call or write to newspaper editors, government officials, and business owners to express your concern or support. Developers do have choices. Try to support efforts that follow the Environmental Protection Agency's guidelines for avoiding unnecessary loss of wetlands: Avoid wetlands destruction, minimize destruction that cannot be avoided, and compensate, by creating new wetlands when loss cannot be prevented.

❖ Educate others about the importance of wetlands and how they can help, too. Lead youth activities that will let others know about the importance of preserving wetlands.

❖ Students can produce posters and flyers, create bulletin boards for school, and design window displays for local businesses, especially businesses such as florists and fish markets that depend directly or indirectly on wetlands. Have students inform and invite friends and family to join in on their efforts.

Case Study:

Concerned Residents Prevent the Destruction of a Slough

The Famosa Slough in San Diego, California was once part of an expansive wetland complex. Construction almost made the slough a memory, until a group of concerned local residents united and became involved. Calling themselves Friends of Famosa Slough, the group convinced the city to purchase the 10 acre channel and 20 acre slough. Together with the San Diego City Parks and Recreation Department, they help maintain, restore, and preserve the slough. To do this, Friends of Famosa Slough act as a community voice, schedule clean-ups, plan restorations, nature walks, and school and youth club outings.

Elizabeth Bay, 11, became involved two years ago. "I heard about the slough when I moved to Ocean Beach," said Elizabeth. "Friends of Famosa Slough were at a street fair passing out information. I love birds and all animals and wanted to help make sure they had safe clean places to live, so my mom let me join." Elizabeth takes part in clean-ups, participates in nature walks, helps raise money for slough restoration, and perhaps most importantly, is a source of information for her peers. "Some of my friends thought the slough was just a smelly place until I took them there to see the animals: gophers, fish, crabs, egrets, terns, herons, and Bonnie and Clyde, the slough's resident ducks. My friends just fell in love with the place and want to make sure it stays around forever." Elizabeth believes that kids can do a lot, and she sure practices what she preaches.

How To Create a Schoolyard Habitat

Whether your school is in the suburbs or in the city, and regardless of whether it is large or small, you can get a natural area growing. Schools that have land around them are great for establishing habitats, but you don't need a lot of space to create a habitat that will attract wildlife and educate children firsthand about all of the concepts presented in this Action Pack. Habitat-creating plants can be planted around playgrounds, or you might consider removing some of the cement from a courtyard to make room for plants to grow. You can grow small trees and other plants in containers, or put in raised beds around sidewalks for flowers. There are lots of possibilities.

Here are some tips for establishing a schoolyard habitat:

1. **Don't go it alone.** You'll need the help of others to make your habitat successful. Creating a schoolyard habitat is easiest and most successful if you involve the entire school and community. It involves work, but it will also bring everyone together to achieve a common goal.

- Remember to include your students. Take them outside to assess your site in the beginning and include them in the discovery and decision making processes throughout.
- The principal and school administration, as well as the maintenance staff responsible for the grounds, will help develop and support the project and keep it growing.
- Fellow teachers can coordinate volunteers and students.
- Students and community volunteers can dig and plant and tend the habitat.
- Community businesses can donate money, volunteer time, and gifts in kind—donations

of items you might need, such as garden tools, signs or benches.

- Parents can help transport kids and work in the habitat.

2. **It's all in the planning.** Form a committee made up of the principal, teachers, students, school staff, parents, and local talent such as gardeners or landscape planners to help plan your habitat. Evaluate your school grounds for good planting areas and places that will foster outdoor learning activities. Make a site plan, develop a budget and timetable, and identify specific needs that will require fund-raising or volunteer help.

3. **Form community partnerships.** Many schools have benefited from donations of money, supplies, and time from local businesses and community groups. A schoolyard habitat is an investment in the children's education as well as in the community, and many people are glad to help.

4. **Start small.** To get everyone in the spirit, begin your habitat with small projects that don't cost much but provide fast results. After the holidays, have people bring their Christmas trees to the school to make brush piles for wild animals to nest and hide in. Rock piles will attract reptiles, amphibians, and insects. Putting out feeders, houses, and water for drinking is a sure way to attract birds. Plant flowers that attract butterflies or hummingbirds—they don't usually require a lot of space. Most garden centers can advise you on what plants work well.

5. **Build on your successes.** What you do with your habitat is really up to you, your school, and your community. You might consider a nature trail, a reforestation project, composting, seeding a wildflower meadow, or putting in a pond. The key to establishing a schoolyard habitat is that you can add to it gradually, as funds and time are available. And even the simplest habitat-enhancing projects afford great learning opportunities.

6. **Certify your schoolyard habitat** with the National Wildlife Federation. The Schoolyard Habitats "How-To" Planning Guide and a pre-paid Application for Certification (item #79948) are $18. Call 1-410-516-6583 or write to National Wildlife Federation, P.O. Box 50281, Hampden Station, Baltimore, MD 21211.

Habitat Wrap-up

A great culminating activity that brings all the concepts of habitat together in a fun way is to have children plan model communities. After all, people need a habitat, too. Consider having a city or land planner come to your class and talk about his or her work. Then let the kids research and design their ideal communities. Specify that each community must contain housing, businesses, transportation, and recreational opportunities. Make sure they think about what will happen to the waste and pollution that are produced. Their goal is to design a community that provides for all of the people's needs and still preserves as much wildlife habitat as possible. Kids can make their models out of recyclable items such as boxes, milk cartons, etc. Have the kids specify the kinds of wildlife that will be able to live in their model world.

APPENDICES

Glossary

Algae - the group of simple aquatic non-vascular plants such as pond scums and seaweeds.
Aquatic - living in water.
Bogs - poorly drained freshwater wetlands characterized by a build-up of peat.
Detritus - bits of vegetation, animal remains, and other organic material that form the base of food chains in wetlands and many other habitats.
Endangered Species - plants and animals that are in danger of becoming extinct.
Estuary - any ocean inlet meeting a fresh water river.
Evaporation - the process by which liquids become gas.
Freshwater Marshes - open wetlands that occur along rivers, lakes, ponds, and other freshwater sources. Sedges, reeds, rushes, and grasses are the dominant plants in freshwater marshes.
Freshwater Swamps - forested or shrubby wetlands. Pocosins and heaths are examples of freshwater swamps.
Habitat - a region inhabited by a plant or animal in the natural state.
Heaths - a plant in the heath family of woody plants that grows in freshwater wetlands or a type of freshwater swamp covered with heather and low shrubs.
Mangrove Swamps - saltwater swamps that occur along tropical coasts. Mangrove trees are the dominant plants in mangrove swamps.
Migrant - an animal that travels from location to location seasonally.
Nursery - a place set aside to raise young.
Nutrients - substances, such as minerals, that plants and animals need in order to stay healthy.
Peat - a dense accumulation of water-saturated, decayed moss and other vegetation.
Photosynthesis - the use of sunlight by plants to produce energy needed to grow.
Playa Lakes - temporary, shallow lakes that maintain independent watersheds. Formed through wind deposition of sandy sediments, playa lakes are found in northern Texas and eastern New Mexico. These lakes provide the second most important wintering habitat for waterfowl, just behind the coastal wetlands of the Gulf of Mexico. In addition, playa lakes are a crucial water source for livestock throughout the region.
Pocosins - a low, flat swampy region in savannahs of the southeastern US.
Prairie Potholes - saucer-shaped depressions formed by retreating glaciers during the end of the ice age that fill with water during portions of the year. They are found predominantly in an area known as the Prairie Pothole Region, which includes parts of North and South Dakota, western Minnesota, and northern Iowa. Prairie potholes are invaluable to migratory birds, supporting 50%-80% of all duck breeding in North America.
Precipitation - the process by which condensed water builds up in clouds and falls to the ground in the form of rain, snow, sleet, or hail.
Run-off - the flow of any substance into a body of water.
Salt Marshes - saltwater wetlands that occur along many coasts north and south of the tropics.
Sediment - silt that is washed or blown from the land and settles at the bottom of wetlands and other aquatic habitats.
Silt - loose mineral and rock particles in water.
Slough - an inlet on a river, marsh, or tidal flat with shallow water and deep mud.
Soil Erosion - the flow of soil into a body of water because of flooding or wind.
Spartina - wetlands grasses found commonly on saltwater marshes, also called *cord grass.*
Sphagnum - a moss found in many bogs.
Wetlands - areas that, at least periodically, have waterlogged soils or are covered with a relatively shallow layer of water. Wetlands support plants and animals that are adapted to living in a watery environment. Bogs, freshwater and saltwater marshes, and freshwater and saltwater swamps are examples of wetlands.

Guide to Wetlands Activities

Looking for more activities for your class? The following chart lists activities from the *Animal Tracks Activity Guide* and the *NatureScope* series that apply to wetlands studies. For easy cross-reference, each activity is listed by grade level and subject.

Activity Name/Source	Specific Grades	Science	Math	Language Arts	Social Studies	Art/ Music	Summary
Create a Scene (NS Wetlands p. 5)	K-2	X				X	Listen to a description of a wetland and create a wetland scene with picture cut-outs.
Make a Mud Snail (NS Wetlands p. 21)	K-2	X					Put together a mud snail puzzle and label its parts.
Amazing Mangroves (NS Wetlands p. 22)	K-2	X				X	Answer questions about a mangrove swamp scene and sing a song about mangrove communities.
Little Green Monsters (NS Wetlands p. 36)	K-5	X					Distinguish real wetland plants from imaginary ones.
Surveys and Slogans (NS Wetlands p. 6)	3-5	X				X	Take a wetland survey and design a wetland stamp, poster, T-shirt, or bumper sticker.
Hidden in the Marsh (NS Wetlands p. 38)	3-5	X				X	Make a paper model of a freshwater marsh community.
Soil Permeability and Toxic Chemicals (AT p. 51)	3-6	X		X	X		Explore the permeability of different types of soil and show how run-off occurs.
Wetland Models (NS Wetlands p. 11)	3-8	X					Make a clay model of a wetland and discover how a wetland works.
Build a Mangrove (NS Wetlands p. 25)	3-8	X				X	Build a life-sized model of a mangrove tree.
Changing with the Tide (NS Wetlands p. 27)	3-8	X					Make a salt marsh display board to show how some animals are affected by the changing tides.
The Great Swamp Debate (NS Wetlands p. 52)	3-8	X			X		Read and analyze two newspaper articles about a wetland issue.
What's Your Wetland IQ?	3-8	X			X		Play a wetland trivia game.

Adopt a Water Friend (AT p. 58)	4-8	X		X	X		Conduct a series of observations to assess the water quality of a local resource.
Put It on the Map! (NS Wetlands p. 12)	6-8	X			X		Use clues to identify the locations of some major North American wetlands.
Gator Hole Graphics (NS Wetlands p. 40)	6-8	X	X				Interpret graphs that tell how some swamp animals survive drought.
Explore a Wetland (NS Wetlands p. 8)	K-8	X		X			Take a walk in a wetland and then make a wetland picture story or fill in a wetland worksheet.
Salty Discoveries (NS Wetlands p. 23)	K-8	X					Hatch brine shrimp eggs and observe their development.
A Taste of Wetlands (NS Wetlands p. 50)	K-8	X			X		Sample some tasty wetland foods.

Key
AT= *Animal Tracks Activity Guide for Educators Grades 4 to 6* (Item 79928)
NS Wetlands= *NatureScope, Wading Into Wetlands* (Item 75025)
All available from the National Wildlife Federation, 8925 Leesburg Pike, Vienna, VA 22184. 1-800-477-5560.

Resources

Resources For Teachers

Animal Tracks Activity Guide for Educators Grades 4-6, published by the National Wildlife Federation, 1995. Available through NWF, 8925 Leesburg Pike, Vienna, VA 22184-0001. Follow the tracks to more action-packed activities. $8.95 includes one copy of accompanying student book (Item 10) http//www.nwf.org/

"Coastal Ecosystems" is an activity unit containing a teacher's guide and student field guides on salt marshes and other water habitats. For a catalog write to Project CAPE, Dare County Schools, PO Box 817, Manteo, NC 27954.

E for Environment, by Patti K. Sinclair. An annotated bibliography of children's books with environmental themes. RR Bowker, New Jersey, 1992

Earth Book for Kids: Activities to Help Heal the Environment, by Linda Schwartz, published by Learning Works, 1990, (0-88160-195-0). Activities to heal the environment.

Earthwatching III: An Environmental Reader with Teacher's Guide, published by the Institute of Environmental Studies, University of Wisconsin, 1990, (0-936287-01-2) Scripts about the workings of nature. Available through the Institute of Environmental Studies, University of Wisconsin, 15 Science Hall, 550 N. Park St., Madison, WI 53706.

Life at the Sea: Wonders of Learning Kit, contains 30 student booklets, reproducible activity sheets, teacher's guide, and a read-along cassette. Order from the National Geographic Society, Educational Services, 1742 Connecticut Ave., NW, Washington, DC 20009.

Nature with Children of All Ages: Activities & Adventures for Exploring, Learning, & Enjoying the World Around Us, by Edith A. Sisson, published by Prentice-Hall, 1982, (0-13-611542-X) Series: Spectrum Books. Tested explorations covering a variety of topics, including wetlands.

Ranger Rick's Nature Scope: Wading Into Wetlands, published by the National Wildlife Federation, 8925 Leesburg Pike, Vienna, VA 22184, 1992. (800) 477-5560. A comprehensive wetlands information and teaching guide. Item 75025. $7.95 plus shipping and handling.

The Sense of Wonder, by Rachel Carson, published by Harper, 1987 (revised edition), (0-06-091450-5). Carson's timeless message inspires adults to embrace and share nature with the children in their life.

Sharing the Joy of Nature: Nature Activities for All Ages, by Joseph Cornell, published by Dawn, 1992, (0-916124-52-5). Nature games for children and adults. Available from Dawn, 14618 Tyler Foote Road, Nevada City, CA 95959.

Taking a Stand Against Environmental Pollution, by David E. Newton, published by Watts, 1990, (LB 0-531-10923-2) Series: Taking a Stand. Highlights those that have made a difference, including a high school student who preserved a swamp.

Wetlands Adoption Kit, contains information on how to help preserve wetlands. For more information write: Izaak Walton League of America, 707 Conservation Lane, Gaithersburg, MD 20878-2983 (301) 548-0150 http://www.iwla.org

WOW: The Wonders of Wetlands and Discovery Watershed: The Everglades, published by Project Wet (Water Education for Teachers). Background information and activities for teachers. Project Wet, Montana State University, Bozeman, MT 59717-0057. (406) 994-5392. $15.95 each.

Resources For Children

50 Simple Things Kids Can Do to Save the Environment, by John Javna, published by Andrews & McMeel, 1990

Animal Tracks, published by the National Wildlife Federation, 1995. Available through NWF, 8925 Leesburg Pike, Vienna, VA 22184-001. The companion student activity book to the Animal Tracks Activity Guide, filled with fun activities for kids. http//www.nwf.org/nwf

Between Cattails, by Terry Tempest Williams, published by Macmillian, 1985, (0-684-18309-9). A visually appealing introduction to the world of marshes.

Energy Flow in a Wetland, is a poster with a game board format, including game rules and background information. Available through the National Science Teachers Association, 1742 Connecticut Ave., NW, Washington, DC 20009.

Estuaries: Where Rivers Meet the Sea, by Laurence Pringle, published by Macmillian, 1993. An excellent source of information about estuaries for middle school readers.

Going Green: A Kid's Handbook to Saving the Planet, by John Elkington, published by Penguin, 1990 (0-670-83611-7). An ambitious, and sometimes irreverent, environmental handbook for children.

Good Planets Are Hard to Find! An Environmental Guide, Dictionary, and Action Book for Kids (and Adults), by Roma Dehr and Ronald Bazar, published by Earth Beat Press, 1989. An A to Z compendium of environmental concepts, issues, and ideas for action. Available through Earth Beat Press, PO Box 33852, Station D, Vancouver, BC, Canada V6J 4L6.

Nature Detective: How to Solve Outdoor Mysteries, by Eileen M. Docekal, published by Sterling Publishing, 1989, (0-8069-6844-3). The author guides and encourages children to take part in outdoor exploration.

Nature Search: Wetlands, by Andrew Langley, published by William Morrow, Inc., 1993. Young readers will see wetlands through the magnifying glass included as part of the cover, and search for their powers of observation.

Secrets of a Wildlife Watcher, by Jim Aronosky, published by Lothrop, 1983, (LB 0-688-02081-X). A "how-to" book for young wildlife watchers.

Swamp Life: A Close-Up Look at the Natural World of a Swamp, by Theresa Greenaway, published by Dorling Kindersley, 1993, Series: Closer Look. Beautiful color photographs enhance the text.

On-Line, Computer, and Video

"A Swamp Ecosystem" is available in film or video for grades 3-9 from the National Geographic Society, PO Box 10597, Des Moines, IA 50340. (800) 368-2728. The film is $36 (Item 50096) and the video is $49 (Item 51217).

"Conserving America: Wetlands" is a video with accompanying activity and resource guide. Supplies are limited; contact the National Wildlife Federation, 1400 16th St., NW, Washington, DC 20036-2266.

"Earth's Endangered Environments: Wetlands," a 30-minute filmstrip for grades 5-8 emphasizing the importance of and many threats to wetlands worldwide. Available from the National Geographic Society, PO Box 10597, Des Moines, IA 50340. (800) 368-2728. The filmstrip is $36 (Item 30797).

Environmental Education Network maintains a web page listing links to numerous environmental education resources. The site is located at: http://www.envirolink.org/enviroed/

"Let's Explore a Wetland," a video with accompanying teacher's guide for grades 4-12 features a canoe trip through the swamp ecosystem, including the web of life that connects the swamp's inhabitants—from alligators to duckweed. Available from the National Geographic Society, PO Box 10597, Des Moines, IA 50340. (800) 368-2728. The video is $79 (Item A51606).

"The Marsh Community and Our Vanishing Marshland" are available in film or video from Encyclopedia Britiannica Educational Corp., 425 Michigan Ave., Chicago, IL 60611.

University of Maryland's Coastal Marsh Project is a project to analyzing the surface condition of coastal marshes to detect areas that are at risk for rapid loss. The site is at http://www.geog.umd.edu/wetlands/Marsh.html

The U.S. Environmental Protection Agency "America's Wetlands" site has information on the rich variety of wetlands, their importance, how they are threatened, and what can be done to conserve them for future generations. The site is at http://www.epa.gov/OWOW/wetlands/vital/toc.html

The U.S. Fish and Wildlife Service National Wetlands Inventory, plans, directs, coordinates, and monitors the gathering, analysis, dissemination, and evaluation of information relating to the location, quantity, and ecological importance of the Nation's wetlands. Has information on resources for educators. The site is at http://www.nwi.fws.gov/. Also includes a list of plant species that occur in wetlands at http://www.nwi.fws.gov/list96.htm

US Wetland Services - find out how a mining pit was returned to a fully functioning wetland. The site is at http://www.uswetlands.com/

The Washington Wetlands Group invites you to get your feet wet! Find out more at their Web site http://www.waypt.com/wetland/

Wetlands Roundtable, a lesson plan for middle school students to role play a mock community meeting/discussion about the proposed development of a shopping mall and its possible impact on area wetlands. The site is at http://www.nceet.snre.umich.edu/Curriculum/wetlands.toc.html

Yaker Environmental Systems offers two wetlands programs for the Apple computer. Estuaries: The Ocean's Nurseries and Biomes II: Wilderness Webs. For information write the Yaker Environmental Systems, Inc., PO Box 18, Stanton, NJ 08885 .

Organizations

GREEN (Global Rivers Environmental Education Network, whose mission is to improve education through a global network that promotes watershed sustainability, is a resource to schools and communities that wish to study their watershed and work to improve their quality of life. 721 East Huron Street, Ann Arbor, MI 48104. (313) 761-8142. http://www.igc.apc.org/green/green.html

The Illinois/Indiana Sea Grant Program offer complimentary Wetlands are Wonderful teacher and student activity guides. Write the Illinois/Indiana Sea Grant Program, University of Illinois, 65 Mumford Hall, 1301 W. Gregory Drive., Urbana, IL 61801.

National Geographic Society offers many educational materials. Contact them at PO Box 10597, Des Moines, IA 50340. (800) 368-2728.

Terrene Institute, a not-for-profit organization coordinating the Communities Working for Wetlands conference during American Wetlands Month Celebration in May 1997. 4 Herbert Street, Alexandria, VA 22305. (800) 726-4853. http://www.terrene.org/index.html

U.S. EPA Wetlands Information Hotline. (800) 832-7282. E-mail: wetlands-hotline@epamail.epa.gov

U.S. Fish and Wildlife Service Division of Habitat Conservation, National Wetlands Inventory. The Publications Unit has publications available free of charge. U.S. Fish and Wildlife Service, Publications Unit, 4040 North Fairfax Drive Room 130, Arlington, VA 22203. (703) 358-1711.

Get Recognized!

Keep America Beautiful
To youth and school groups for environmental improvement. Annual.
Keep America Beautiful
Awards Program Coordinator
9 West Broad Street
Stamford, CT 06902
(203) 323-8987

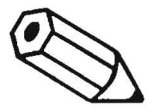
President's Youth Service Awards
To youths ages 5-22 for community service.
President's Youth Service Awards
PO Box 310
New Castle, DE 19720

Albert Schweitzer Environmental Youth Award
To youth's and youth groups ages 12-18 for environmental change in the community.
Albert Schweitzer Institute for the Humanities
PO Box 550
Wallingford, CT 06492-0550
(203) 697-2741

National Geographic World
National Geographic World has two ways for kids to get noticed. The first is an annual event sponsored by Pizza Hut called The Kid's Hall of Fame. The second, Kids Did It! is a monthly feature.
National Geographic World
Dept. Hall of Fame
PO Box 96000
Washington, DC 20090-6000

Wildlife Education, Ltd.
Each monthly issue of Zoobooks contains activity pages with a Kid's Corner where kids can get noticed.
Wildlife Education Ltd.
Kid's Corner
9820 Willow Creek Road Ste. 300
San Diego, CA 92131
http://www.zoobooks.com

Notes...



Other NWF Education Programs

The National Wildlife Federation has many education programs and resources available. Here's how to find out more about them...

ANIMAL TRACKS®

Animal Tracks® is a classroom education program of the National Wildlife Federation focusing on teacher training and environmental education resources. In Animal Tracks materials, the animals and their tracks lead educators and students on an exploration of conservation issues. For more information call (703)790-4236, e-mail kier@nwf.org, or visit our website at http://www.nwf.org/atracks/

NATIONAL WILDLIFE WEEK

During **National Wildlife Week**, National Wildlife Federation distributes over 620,000 kits to teachers across the country. For the 1998 Wildlife Week, April 19 to 25, the theme is "Nature's Web: Caring for the Land." National Wildlife Week Kits are distributed through individual NWF Affiliates. Consult the NWF Conservation Directory or your local library or phone book to find the address of the NWF Affiliate in your state to request a kit, or contact the National Wildlife Federation at (703) 790-4100 or wildlife@nwf.org.

SCHOOLYARD HABITATS®PROJECT

Schoolyard Habitats program encourages and assists school communities in establishing habitat-based learning sites. The program emphasizes wildlife habitat conservation on school and learning center grounds, cross-curriculum learning and teaching and community involvement. For more information call 1-703-790-4582.

RANGER RICK®

Ranger Rick is a monthly magazine for kids aged 7 and up. Each 48-page issue is loaded with colorful animal photos, funny drawings, and exciting stories that turn kids on to nature, outdoor adventure, and helping the environment. Cartoons, riddles, crafts, games, and far-out animal facts make Ranger Rick fun for everyone. For subscriptions call toll-free 1-800-588-1650 and give the operator source key RRWEB7 or write to Ranger Rick at NWF for more information.

YOUR BIG BACKYARD®

Your Big Backyard® is a monthly magazine for kids aged 3 to 6. Each issue sparks a child's natural curiosity as it introduces them to the wonderful world of nature with charming photos of baby animals, read-to-me stories, poems, riddles, and games. This special magazine combines close-up pictures with simple text to help kids start on the road to reading. Your Big Backyard has a parent and educators guide that includes nature activities, crafts, developmental tips, and nature-related product reviews. For subscriptions call toll-free 1-800-588-1650 and give the operator source key RYWEB7 or mail a check or money order for $14 (12 issues) to Your Big Backyard, PO Box 775, Mount Morris, IL 61054-8273.

BACKYARD WILDLIFE HABITAT™ PROGRAM

The Backyard Wildlife Habitat program encourages people in all parts of the U.S. and Canada to supply the basic elements that wildlife need to survive: food, water, shelter, and a place to raise young. Anyone with a yard, no matter what size, can easily create a home for wildlife. Once the basic elements are provided, one may apply for certification and join the list of over 18,500 official Backyard Wildlife Habitats. To order an information kit about this program; containing a planting guide, a copy of *The Backyard Naturalist* by NWF's chief naturalist, and an application, call 1-703-790-4100.

EARTHSAVERS®

EarthSavers is a club program for kids (ages 6-13) who care about the environment and want to help. Together with their adult leaders -- many of whom are teachers -- EarthSavers club members use the quarterly *EarthSavers* newspaper to learn more about nature and wildlife and to find out what other kids are doing to improve and protect the natural environment in their communities. In addition to the newspaper, each club leader receives free of charge an *EarthSavers Activity Guide* to coincide with each issue, as well as a leader's handbook and membership cards. For more information and a registration form, write to: EarthSavers; National Wildlife Federation; 8925 Leesburg Pike; Vienna, VA 22184.

EARTH TOMORROW®

EARTH TOMORROW® is an innovative environmental education and leadership program for high school teachers and students in the city. It is designed to create an awareness for conserving natural resources and to provide opportunities for action at the individual and community level. Teacher workshops provide training and resources in environmental education to urban educators that are not readily available within the city. Students explore environmental issues, identify, and propose solutions to local areas of concern by attending a residential summer workshop at a local university and going on field trips. On-going support and follow-up is provided as students and teachers form school clubs to implement conservation action projects that are designed to foster coalition building within the community. EARTH TOMORROW® is currently being piloted in Detroit, MI, by NWF's Great Lakes Natural Resource Center (GLNRC) in cooperation with the Michigan United Conservation Club (MUCC). For more information, call NWF's GLNRC, 313-769-3351, or visit our web site at: http://www.greatlakes.nwf.org/educ/earthtom.htm

CAMPUS ECOLOGY

Campus Ecology establishes environmentally sound practices on college campuses by promoting leadership and action within the campus community. By communicating to campus organizers what other students, faculty and administrators, and the broader environmental community have learned, Campus Ecology recognizes the efforts of people who work on outstanding projects by documenting and publishing their accomplishments. For more information, call 703-790-4318.

RANGER RICK'S WILDLIFE CAMP™

Ranger Rick's Wildlife Camp is a unique opportunity for camps and youth-serving organizations to partner with NWF and operate an environmental program model on their own site. Complete with an exciting variety of curriculum materials, program manuals and an administrative guide, the model encourages young people to develop an attitude of environmental stewardship through involvement in a series of hands-on- learning activities in an outdoor setting. Whether planning one week or two, at a day or resident camp, nature center or club house--Ranger Rick's Wildlife Camp blends nature discovery with exciting outdoor adventures. For more information about this program, call 1-703-790-4568/4536.

CONSERVATION SUMMITS®

Conservation Summits provide unique learning opportunities for teachers, outdoor educators, youth leaders and parents at some of America's most spectacular sites. During these week-long, family-oriented adventures, participants can take advantage of special classes that provide instruction on introducing children and students to the study of nature and the environment. Classes include integrating environmental education into an existing curriculum, teaching techniques for nature study, and an introduction to available environmental education materials. University credit is offered at all locations. For more information, call 1-800-245-5484.

NATURELINK®

NatureLink is an affordable family outdoor education program designed to engage families in hands-on outdoor learning, while fostering awareness of their environment and encouraging environmentally-responsible lifestyles. Participants work with mentors to learn about outdoor themes and build outdoor skills (e.g., wetland ecology, fishing). Afterwards, they create a Earth Pledge--a statement of their commitment to take action in their homes or community on behalf of the environment. The National Wildlife Federation trains and partners with community organizations to host NatureLink programs across the United States. For more information, please call 703-790-4100.

CONSERVATION DIRECTORY

The **Conservation Directory** is an annual publication of the National Wildlife Federation and continues to be the most complete source for up-to-date detailed information on environmental conservation organizations. The 1998 edition lists over 2000 governmental and non-governmental organizations and personnel involved in conservation work statewide, nationwide and worldwide. The directory may be purchased by calling 1-410-516-6583. The 1998 edition is $61.00 plus shipping and handling. For more information about getting your organization listed, call 703-790-4402.

NATIONAL WILDLIFE PRODUCTIONS

National Wildlife Productions, Inc. (NWP) is the television, film, and multimedia arm of the NWF. NWP's mission is to produce IMAX® films, television programs, and other media that entertain people while opening their eyes to the importance of conservation. NWP creates original programming for networks such as TBS Superstation, The Disney Channel, Animal Planet, Home & Garden Television, The Travel Channel, The Outdoor Life Network, and public television. Consult our website at **www.nwf.org/nwf/nwp** for additional program information and the latest programming updates.

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ABOUT ANIMAL TRACKS ACTION PACKS

Animal Tracks Action Packs are a classroom resource educating students about environmental issues through discovery, awareness, and action. Look for Action Packs on recycling, water, and habitat, with more topics to come!

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